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THE HILUS OF THE LUNG IN THE CHILD¹

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THE problem of the hilus has engaged the attention of roentgenologists since the beginning of roentgenologic diagnosis of lung conditions, and, in addition to a large number of clinical investigations, reports of innumerable experimental researches on the subject have been published, so that it seems unnecessary for me to give a survey of the literature. While it is a matter of common knowledge that the so-called hilus shadow is formed chiefly by the branches of the pulmonary artery, and that the bronchial walls deepen the shadow in a scarcely perceptible manner, nevertheless, the question is not yet fully settled as to when a hilus is to be regarded as normal and when it is to be considered pathologic. Formerly every shadow in the hilus region was regarded as pathologic, or at least as suspicious. When, however, it was established later that hilus shadows are to be found likewise in perfectly healthy persons, one fell into the opposite error of being entirely too reserved in the diagnosis of the hilus process. A final decision is extremely difficult; for in no other region are the dividing lines between the normal and the pathologic so indistinct as in the hilus area.

Before I take up my special topic, I must not fail to consider more closely the term

"pathologic." The term has two distinct meanings: first, *diseased*, and secondly, *not normal*. A condition may not be normal; for example, a roentgenologic observation may be made that does not correspond to the normal (which is pathologic in the second sense), without there being any clinical evidence that disease obtains (pathologic in the first sense). As an example, I may cite spina bifida occulta. It is perfectly evident that it cannot be maintained that a vertebra which presents splits is a normal vertebra; but, on the other hand, this observation is made in about 10 per cent of the cases as a secondary finding, although no clinical symptoms are produced. Further examples of the kind might be cited. Precisely with reference to the hilus this distinction is of especial importance, since in adults there is no really normal hilus, although it is not necessarily pathologic in the first sense. But even in the hilus of the child increases of size and density are found that, in the absence of all clinical symptoms, cannot be regarded as pathologic. It is the inexact use of the word "pathologic" that has led to the confusion that very generally obtains in the diagnosis of hilus conditions.

As stated in the beginning, I cannot, within the limits of this paper, discuss the literature to any great extent; but I would like to call attention to an article by Engel (*Ergeb-*

¹Presented at the eighth Congress of the German Roentgenologists and Radiologists of the Czechoslovakian Republic, held in Prague, Nov. 8-9, 1930.

nisse der inneren Medizin und Kinderheilkunde, II), which deals in a thorough manner with the anatomic basis, and also to the researches of Assmann, and, more particularly, to his article on measurements of the hilus (*Münchener medizinische Wochenschrift*, 1920, 177).

On the basis of examinations of several thousand children, taken, for the most part, from the Raudnitz children's ambulatorium (the aid center for the tuberculous, established by the Prague chapter of the German Society for the Aid of the Tuberculous), the Langer children's clinic, and my private practice, I have endeavored to throw some light on the question as to when, in children, an involvement of the bronchial glands can be assumed and when such involvement may be excluded.

By means of measurements of the hilus, after the manner of Assmann, which were originally undertaken for the determination of changes of the hilus in the presence of heart defects, no important results can be secured in tuberculosis of the bronchial glands, especially in children. In order to obtain comparative values, Assmann always measured the same portion of the hilus, which was, of course, right to the purpose, since, in the presence of cardiac defects, the whole hilus is extended in a uniform manner. But the conditions are different in glandular enlargements; for here it is only a question of circumscribed expansions that may be located in widely different parts of the hilus. If measurements were always taken at the same place, often no expansion could be found, in spite of existing disease, when the enlarged glands are located higher up or lower down. A uniform expansion of the whole hilus is exceedingly rare in the presence of involvement of the bronchial glands. Usually only that portion of the hilus is expanded in the area of which the primary focus belonging thereto is located. The question of these foci I will take up again later in this article. A perfectly uni-

form expansion points accordingly away from, rather than toward, an involvement of these glands, and suggests only a stasis in the lesser circulation. It is often difficult to decide what causes circumscribed expansions. But they can be ascribed with certainty to enlarged glands if the margin of the hilus shadow presents a somewhat irregular or interrupted circular outline, and if, in the presence of several interrupted arcs, notches may be seen between them that correspond to the angle between two adjoining lymph glands. The diagnosis becomes still easier if it is a question of especially large collections of glands, in which a dense shadow that can be differentiated from the hilus is found which projects a considerable distance into the lung area and is sharply demarcated. The diagnostic differentiation of such bundles of glands from a pulmonary infiltrate is, to be sure, sometimes rather difficult. But the latter is usually separated from the hilus, nor does it show such a sharp demarcation, which is especially important when there is a combination of glandular enlargement and infiltration of the adjacent portions of the lung.

From what has been said it will be seen that in the diagnosis of hilus conditions in the child, much more than in the adult, the *width* furnishes little evidence for the diagnosis of glandular enlargement. More important than the width of the shadow is its *density*. It should be noted, however, that this increase of density may concern the hilus as a whole or may be confined to certain portions. In the latter case, an area of considerable extent shows increased density (similar to the expansion corresponding to the outlying flooded area of a primary focus), or one may observe in the otherwise normal hilus smaller, roundish (mostly oval) areas of increased density. I scarcely need to emphasize that, as regards the latter, one must avoid confounding them with cross-sections of blood vessels by turn-

ing the patient about to see whether the shadow retains its form or whether it dissolves itself into the shadow of a blood vessel.

A dense hilus shadow awakens at least the suspicion of an involvement of the glands. The decision whether it is a question of recent or spent processes cannot, to be sure, be reached with certainty. As a rule, it may be said that, the denser the shadows are, the older the process is, since caseous glands or glands that have undergone fibrous changes produce a denser shadow than those that are merely swollen and pulpy, while calcified glands produce shadows still more dense. Calcification points doubtless to a healing of the process, but adjacent to the calcified parts there may be more recently involved areas. Furthermore, it is a well known fact that regional lymph glands that have apparently healed anatomically may harbor infective tuberculous virus for years, and then may become the point of departure for an endogenous reinfection. Moreover, since, as has already been mentioned, hilus calcifications are particularly rare in children, only the clinical findings settle the question as to whether the glandular involvement detected roentgenologically is acute or whether it is a spent process. If there are no clinical symptoms, a glandular shadow discovered with the roentgen ray is to be ascribed to a spent process. In that case, only slightly denser areas are concerned, since, in my experience, in the majority of cases in children, diseased glands, when they heal clinically, retrogress nearly to normal and no longer present any considerable shadow.

Such an evaluation of the differences in density is of course subjective; different examiners will not always reach the same conclusions, and hence the evaluation cannot, strictly speaking, be recognized as a criterion of a glandular involvement. Fortunately, this evaluation can be made more objective, since nature has placed an object of comparison at our disposal;

namely, the hilus of the other side. This comparison enables us to reach a decision (which is especially important when the roentgenologic findings are slight) as to whether or not there is a pathologic change in the hilus. Usually too little importance is attached to a comparison of the two hilus shadows.

In making the comparison, the anatomical relationships must naturally be considered first, and, in that connection, I call attention to the above mentioned article by Engel. Three different groups of glands must be distinguished: the tracheobronchial glands, the glandulæ bifurcationis, and the bronchopulmonary glands. The first two groups are not so important for the roentgenologic diagnosis. The bifurcation glands fall entirely within the middle of the shadow and will not cause a bulging of the shadow unless they become greatly enlarged. In both groups it should be noted that the glands on the right side are more numerous and larger, and laterally and anteriorly lie close to the tracheobronchial tree.

In the third group, usually designated by the clinician as hilus glands, there is no preponderance of the right side with respect to the number and size of the glands, although here, as well, the conditions for the exhibition of the glands in the roentgenogram are more favorable on the right side than on the left, where the glands are frequently covered by the middle shadow or by the heart shadow.

It appears, at first sight, as if these anatomic conditions would render a comparison of the two sides extremely difficult. The differentiation in the two sides in the first two groups is, however, of no importance, as these groups, as already mentioned, are very rarely recognizable in the roentgenogram. In other words, a comparison can be made only between the hilus glands proper. Owing to the fact that the left hilus is partly covered by the heart shadow, the right hilus appears broader than the left. It may be

noted also that the glands of the right side more frequently become involved than do the glands of the left side, which I (in agreement with most authors) observed also in my series of cases. It is owing to these two circumstances that little importance has been attached to a comparison of the two sides, since nearly always a differentiation of the two hila is observable. This is doubtless correct and cannot be denied if the usual angle of roentgenoscopic examination (the purely sagittal) is employed. The result is different, however, if the exposure is so adjusted as to disassociate the left hilus from the heart shadow. This is easily accomplished if the patient is turned a trifle to the right on his body axis (left shoulder toward the front). The patient must not be turned too far, since the hilus will otherwise be obscured by the spinal column. In such a position the left hilus is visible in its whole extent, and if one then turns the patient in a similar manner to the left (right shoulder to the front), two roentgenograms just such as are needed for comparative purposes will be obtained. It thus becomes easy to demonstrate even slight changes in the width or density by comparing one side with the other.

It is a well known fact that involvement of the lymph glands is secondary and that the involvement results from metastasis from a primary pulmonary focus. In the acute stage, the primary pulmonary focus is almost never visible; the swelling of the bronchial glands is, however, especially marked. Thus, the roentgenologic examination in this stage will be especially valuable, since an expansion and increased density of the hilus are in such cases nearly always demonstrable, unless our diagnostic insight should be limited by the fact that the bifurcation glands, which are often diseased, are not visible in the roentgenogram. Not until a later stage do the primary foci become visible either as calcified or as uncalcified isolated areas of density, which change their

position with the respiration, and especially if they lie off to one side and below the hilus. In co-operative researches carried out with Dr. Spitz on children from the Raudnitz ambulatorium, we found that most of these foci are in the lower field and usually some distance from the hilus. The size ranges from that of a millet seed to that of a cherry. As already mentioned in connection with the bronchial glands, we found also in the primary focus a preponderance of the right side. The most frequent localization was the seventh intercostal space.

Frequently we could also show that from these foci thinner or thicker strands extend to the hilus. Sometimes several strands are found with the focus lying either directly at the end of one of these strands or even among the strands. Frequently, however, we find only these strands without any evidence of a focus. These fan-shaped bundles of strands lie most frequently in the lower field or beneath the clavicle. Owing to the fact that we can show that they form direct connections between the primary focus and the hilus, we must consider them doubtless as infiltrated chains of lymph glands with a reactive increase of the connective tissue. A postmortem demonstration is not possible, since, in such mild cases, we never have an opportunity for an autopsy, and these strands usually disappear completely later. We are, therefore, dependent on conjecture in trying to explain the nature of the strands that do not proceed from a focus. Since in their form they cannot be distinguished from the connecting strands between the hilus and the focus, I feel inclined to assume that we are concerned with infiltrated lymphatic vessels and connective tissue that has undergone changes due to inflammation. This assumption receives some support from the researches of Meller and Menkes, of Bucharest, who attempt to explain the rôle of these two formations in the roentgenogram of the lungs by bringing about an artificial swelling of the connective

tissue of the lungs and by injection of the chains of lymph glands. The thus swollen connective tissue certainly produces pictures similar to the pictures produced by these strands. Whether these strands have only thickened connective tissue as their substratum or whether in addition infiltrated chains of lymph glands play a part in the formation of these shadows, I cannot decide, but it is to be assumed that, in the acute stage, also the lymph vessels are involved, whereas, in the chronic stage, probably only changes in the connective tissue are presented. Perhaps the further researches of Meller and Menkes will bring an explanation of the matter. In any event, these chain formations must be produced by inflammatory processes.

I have avoided up to this point discussing the nature of these inflammations and did not consider this question thoroughly in connection with the glandular swellings. Of course, where we can demonstrate roentgenologically a distinct primary complex, we can assume the tuberculous nature to be certain. In the remaining cases, however, we cannot establish roentgenologically the nature of the inflammation; for also other infectious processes—namely, influenza and pertussis—lead to glandular swellings at the hilus. To be sure, that etiology is relatively rare in comparison with tuberculosis of the bronchial glands, so that, in the majority of the cases, we can conclude that a tuberculous infection exists. Also the clinical findings will aid in reaching a decision. In fact, the clinical findings are always indispensable in establishing the diagnosis; for sole reliance cannot be placed on the roentgenologic examination, just as a clinical examination without the roentgen findings is worthless. A clinical diagnosis of tuberculosis of the bronchial glands always remains a presumptive diagnosis, whereas the roentgenologic examination brings a demonstration of the diseased glands themselves, and not until then is an exact diagnosis possible. On the other hand, in endeavoring to decide

whether it is a question of active or spent processes, the clinical examination is of decisive importance.

Up to this point, I have discussed only the question as to when we can assume an involvement of the hilus in the child. There is, however, a second question; namely, as to when an involvement of the bronchial glands can be excluded. This question can be answered in a few words. We can never exclude such involvement, because (as already mentioned) a portion of the glands can never be exhibited roentgenologically, and, furthermore, because, at the beginning of the involvement, the glands are not necessarily sufficiently changed to produce a shadow.

SUMMARY

The roentgenologic diagnosis "tuberculosis of the bronchial glands" is not ordinarily reached as often as it should be, especially in children.

The width of the hilus does not furnish important evidence for the diagnosis. The density of the hilus is more important than the width. A hilus showing increased density is always suspicious, whether it is a question of a general increased density or of smaller circumscribed foci presenting increased density. Calcifications are rare in the hilus of the child.

Very great importance attaches to the comparison of the two hilus shadows. Inequality of the shadows is decisive for the diagnosis. In making this comparison it is necessary to exhibit both hila in their whole extent, which can be accomplished only by turning the patient about slightly on the body axis.

In the majority of the cases any enlargement of the glands is due to tuberculosis. In cases that are not just recent, a primary focus of the lung as the starting point of the glandular involvement can usually be demonstrated. If such a primary focus cannot

be demonstrated, one should recall that there are other infectious processes that may give rise to a glandular enlargement.

Frequently, longer or shorter dense strands extend to the hilus, particularly from the lower field; these are ascribable in part to infiltrated lymphatic paths and in part to inflammatory changes in the connective tissue.

Certain groups of glands cannot be exhibited in the roentgenogram, as they fall within the middle shadow; hence, in the ab-

sence of a positive roentgenologic finding, an involvement of the glands cannot be excluded. Therefore, the roentgenologic examination in itself does not suffice for the establishment of the diagnosis, and must be supplemented by other clinical methods of examination. The roentgenologic examination constitutes, however, the most important part of the whole examination, and an accurate diagnosis of hilus involvement is impossible without a roentgenologic examination.

CLINICAL AND ROENTGENOLOGIC ASPECTS OF CHRONIC ULCERATIVE COLITIS¹

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THE disease known as chronic ulcerative colitis involves primarily the large intestine; it may affect all or any part of it and occasionally it affects the terminal portions of the ileum. The disease is a serious depleting infection; it is difficult to control, and has numerous devastating complications. If not checked it may progress to miserable chronic invalidism.

In the last decade the cause of chronic ulcerative colitis has been studied intensively and considerable information concerning it has been accumulated. The condition has been reported from all parts of the civilized world, although it seems more prevalent in the north temperate zone. Few such patients have come from the tropics and none that we know of from the frigid zones. The disease occurs in every State in the Union. General debility or depletion from any cause has been known to predispose to the disease. Among the known predisposing factors are:

1. Infections of the upper part of the respiratory tract, and acute contagious diseases, such as influenza, pneumonia, tonsillitis, sinusitis, acute colds, measles, and scarlet fever, may leave this disease in their wake, or it may develop simultaneously with these infections.

2. Distant foci of infection, such as septic teeth and tonsils, occasionally infected gall bladders, and appendices, have been known to harbor the organism of chronic ulcerative colitis, and their removal has been followed by marked ultimate improvement. Occasionally acute temporary exacerbations follow the removal of such foci. Experimental production of foci, by devitalization

of the teeth of dogs and infection of the pulp canals with the organism of the disease of human beings, has resulted later in the development of typical chronic ulcerative colitis in these dogs.

3. Operations on the abdomen and rectum have occasionally precipitated attacks of chronic ulcerative colitis. It has been noted after gastro-enterostomy for peptic ulcer, cholecystectomy, removal of extensive pelvic disease, and rarely after operations on the anus for conditions such as hemorrhoids and fistula.

4. Psychic factors and serious mental conflict have been known to precipitate acute exacerbations of the disease or to be factors in its initial production. Types and races of people have little, if any, bearing as causative factors in this disease.

The conditions mentioned undoubtedly aid or prepare the soil for the organism responsible for the infection. Much experimental and clinical evidence suggests that a diplostreptococcus, closely resembling pneumococcus, but of characteristic morphologic and biologic properties, plays an important part in the etiology of this disease. There is some evidence that dissociation of this organism may take place or that mutation forms exist, which play a part in various stages of the disease.

Certain observers have felt that chronic ulcerative colitis is a form of bacillary dysentery or a late residue of this infection, but recent experimental evidence, to be reported elsewhere, convincingly dispels this hypothesis.

In a consideration of the pathologic changes of chronic ulcerative colitis, it would seem best to include the changes seen

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Fig. 1. Chronic ulcerative colitis involving the rectum, sigmoid, and the distal segments of the descending colon. The opaque material has not been well retained in the rectum. The sigmoid and distal descending colon are narrowed. There are no haustra and the wall is markedly thickened.



Fig. 2. Chronic ulcerative colitis involving the entire colon. Attention is called to the lack of haustral markings and to the very straight course of the colon.

in living patients, as well as those seen at necropsy. Changes in the former are best viewed with the sigmoidoscope and present a characteristic picture. Buie's description leaves little doubt about the condition being an entity. Actively advancing chronic ulcerative colitis seems to pass through various stages, leaving always the typical granular, easily bleeding, diffusely inflamed wall of the rectum, with subsequent narrowing of the lumen. Early, there is hyperemia, then edema, followed by, or associated with, miliary abscesses and finally miliary ulcers. The latter, by confluence and necrosis from pressure, result in large, shaggy ulcers, with strips or islands of mucosa between. It is on these islets of mucosa that the typical signs of a granular, easily bleeding lining remain, and it is this last stage of the disease that is seen at necropsy. Involvement

is diffuse, including all layers of the bowel, and marked thickening of muscularis, muscularis mucosae, and mucosa is brought about by replacement of normal tissue with extensive granulation tissue. Most of the mucous membrane will be absent, sometimes as much as 90 per cent of it, with only hypertrophied islets of inflamed mucous membrane remaining. These may remain as bridges or tags or strips of mucosa, and may form the pseudopolyps which, in turn, may undergo adenomatous change.

The history of chronic ulcerative colitis is always suggestive of the disease. There will be frequent, bloody, mucopurulent rectal discharges mixed with varying amounts of feces. There will be urgency and straining at stool. Often the patient will complain of tenesmus and borborygmus. The symptoms may begin insidiously, with gradual in-



Fig. 3. Chronic ulcerative colitis involving the entire colon with multiple areas of localized constriction.



Fig. 4. The entire colon is involved with chronic ulcerative colitis. The contours of the colon are feathery, due to the presence of numerous, deep, submucosal excavations communicating with the lumen of the bowel by fine fistulous tracts. The process is exceedingly virulent.

crease in frequency of rectal discharges, slow loss of weight, failing appetite, and distress evident in the facies. There may be partial or complete remission for weeks and months, and recurrence of symptoms of greater severity, until the process is giving trouble continuously, with the result that the patient becomes a chronic invalid, who must remain near a toilet-room. Again, the early symptoms may be those of an acute, fulminating illness, with a septic type of fever, many bloody, purulent rectal discharges, night sweats, and herpes labialis. Occasionally, at this time, the diplostreptococcus is obtained by culture of the blood. In many respects the condition may resemble severe pneumonia, except that the discharges are intestinal instead of bronchial and tracheal. Gruelling cramps and a peculiar, gray pallor are common. Varying degrees of anemia exist. In the severe cases, a morbid body

odor prevails. There may be an anxious, rather hopeless facial expression. Except for a diffusely tender abdomen, there are no distinctive physical signs. Digital rectal examination gives a clue to the disease. The rectum will be diffusely narrowed, and its wall often will be studded with soft, nodular, plateau-like excrescences of mucosa.

Examination of the rectal discharges, with the naked eye, is of great value. The discharges are soft, semi-liquid, bloody, mucopurulent masses, usually composed predominantly of pus, but at times mostly of blood, and containing blood clots as well as blood intimately mixed with the stool and discharge. Microscopically, much of the discharge is made up of leukocytes, and among the bacterial forms streptococci predominate. The blood picture reveals some degree of anemia and often varying degrees of leukocytosis. The latter is rarely high.

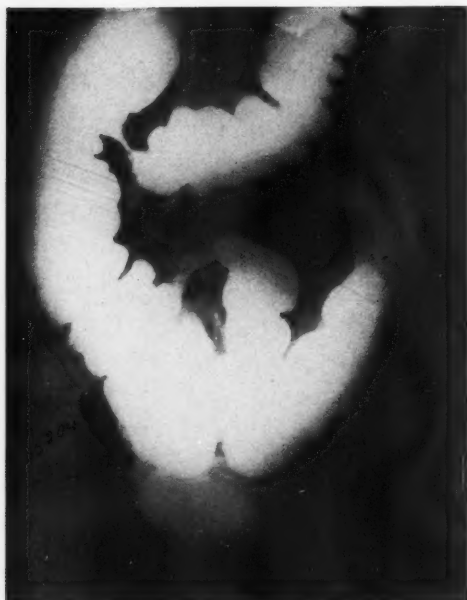


Fig. 5. Localized chronic ulcerative colitis without rectal involvement. There is an area of narrowing in the sigmoid which is active. The organic stricture in the limb of the transverse colon of the hepatic flexure, which is assumed to be the end-result of a process similar to that in the sigmoid, may be noted. These lesions were verified at surgical exploration.

In such a severe infectious disease, it is readily seen that part of its toll is taken by its complications and sequelæ. These have included in our series of cases, polyposis, stricture of the intestine, arthritis, perirectal abscess, lesions of the skin, renal insufficiency, endocarditis, splenomegalia, perforation of the colon, malignant disease, ocular disease such as forms of uveitis, fatal hemorrhage, mesenteric thrombosis, and tetany.

The underlying lesion readily explains the roentgenologic manifestations of the disease. The diffuse nature of the disease, involving not mucosa alone but all coats of the intestinal wall, offers a characteristic picture of those segments involved.

In the investigation of a colon suspected of being the site of chronic ulcerative colitis it has been the practice at the Mayo

Clinic to use a fairly thin emulsion of barium for the enema, at a temperature corresponding as closely as possible to that of the body (2). The barium meal shows nothing more than rapid emptying, and it is impossible, with it alone, to obtain a satisfactory idea of the contours of the lumen, and the condition and size of the bowel. The proper preparation of the patient is significant, because in spite of numerous evacuations small clumps of foreign material adhering to the wall of the bowel are confusing.

As the barium enema enters the bowel, the filling of the rectum must receive closest attention, because in about 20 per cent of cases the disease is confined to this area alone. If the disease is not of long standing there may be no roentgenologic evidence, or the only sign may be that of extreme hyperirritability. The patient will not be able to retain the enema long, so violently does the inflamed mucous membrane resent anything in contact with it. Usually, however, by sustained effort the patient will be able to retain the enema sufficiently long to permit filling of all of the colon, but by the time a roentgenogram has been made the rectum will have been emptied, leaving the colon filled only above the rectosigmoid juncture. This gives a characteristic picture: the ampulla, with enough barium adherent to its walls to show its contour, is markedly narrowed and exhibits a series of coarse linear striations which are the shadows of barium retained in the folds of the vigorously contracted bulbous ampulla. As the disease progresses, either with long continuation of the infection or after repeated exacerbation and secondary infection, the characteristic thickening, contraction, and shortening take place, and the bulbous shadow of the normal broad ampulla may be changed to one which is narrow, straight, and tubular (Fig. 1).

In a typical, well-advanced case one is struck with the rapidity with which the colon fills; the ileocecal valve is reached in an

instant, and if the cecum is involved the valve is always patent. The colon itself is small in caliber, and if ever there was any redundancy it has disappeared; both the size of the lumen and the length of the colon have been reduced. The course of the colon is exceedingly straight, and the angles at the flexures approximate right-angles (Fig. 2). From a soft, pliable, thin-walled, gently winding, and twisting tube the colon has become a thick-walled, hard, inflexible, stiff, straight pipe with a small lumen somewhat analogous in form and general appearance to a thick-walled, tense, sclerotic artery. This picture is not easily confounded with that of any other disease of the colon.

Occasionally one or several contracted areas are seen, giving the bowel the appearance often described as that of a string of sausages (Fig. 3). The constrictions may be organic strictures or may be due entirely to localized spasm. Spastic constrictions tend to vary in situation and appearance, at different times, and are likely to disappear entirely, or at least to diminish in intensity, after the administration, to physiologic effect, of a suitable antispasmodic.

Destruction of the mucous membrane, depending on the extent and the depth of the penetration, causes a varied appearance. If the regions of ulceration are superficial the contour may be entirely smooth, and if they

are deep, the outlines of the colon are feathery or furry and appear moth-eaten or fringed. If the ulcerations are deep the contour is entirely different; it is rough and uneven, and many niche-like projections are seen extending out from the wall of the bowel (Fig. 4).

It is extremely important constantly to bear in mind the occurrence, rare as it is, of localized areas of chronic ulcerative colitis in isolated segments of the colon, without involvement of the distal segments and rectum (Fig. 5).

SUMMARY

Chronic ulcerative colitis is an infectious disease of the large intestine. Factors predisposing to the disease include any debilitating or severely fatiguing condition, infection of the upper part of the respiratory tract, distant foci of infection, and psychogenic states. The organism of immediate etiologic significance is streptococcal. The characteristic lesion is the basis for definite roentgenologic evidence.

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AIR AND GAS IN THE SOFT TISSUES: A RADIOLOGIC STUDY¹

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THE absence of radiographic density, or the negative density, of air and gases of all kinds causes them to cast distinctive shadows, familiar to all of us, on X-ray films. In addition to films of parts of the body which normally contain air, on films of any part of the abdomen the shadows of gas or air in the alimentary canal are always present. These vary in size from small bubbles and isolated pockets in the stomach and large intestine to wide inflation of the greater portion of the colon. On films of other parts of the body, however, the presence of shadows cast by air or gas is of rare occurrence. They are always found associated with injuries in which the skin is penetrated, with laceration of the underlying soft tissues, or in injuries which cause leakage of air from a damaged lung. The presence of air in wounds of these kinds is of minor importance, but the detection of gas caused by infections with anaërobic organisms is often of major clinical significance. Except during the World War, the subject of the radiographic detection of gas infections has received but little attention. To recall to the minds of radiologists and to point out to other medical practitioners the diagnostic importance of the shadows of air and gas on X-ray films, this investigation was undertaken (Figs. 1, 2).

Radiolucent areas in the form of single or multiple oval or circular dark or black shadows have been found around the fractured ends of bones in compound fractures after the ends of the bone have been pulled back into the soft tissues. These shadows decrease rather rapidly in size and soon disappear. They are always limited to the region of the fractured ends of the bone, are usually of appreciable size, and are

sharply defined. They are thought to be caused by bubbles of air in the soft tissues, air that was sucked into the wound when the ends of the bones were pulled back through the skin.

Small quantities of air in the form of bubbles may be carried into the soft tissues in other types of penetrating, lacerating, or crushing injuries in which the skin is broken. The shadows of air have been found on films of both shotgun and pistol wounds. In the former, they are always located in proximity to the shot and never extend into the soft tissues in any direction from the actual location of the injury. In pistol-shot wounds, a few small bubbles of air may be found along the track of the bullet soon after the injury. In both instances the air is rather rapidly absorbed (Figs. 3, 4).

Crushing and lacerating injuries, as of the hands and feet, when examined by means of X-ray films, will often show a number of bubbles of air in the soft tissues. These are of various sizes, with sharply marked borders. They are always limited to the region of the injury, never extending into uninjured tissue. In one instance, an X-ray film taken soon after an amputation showed a large number of minute bubbles of air in the soft tissues of the stump, incorporated between the different layers of the flaps. They did not extend beyond the severed end of the bone, nor around the bone beyond the limits of the flaps.

When lacerated or penetrating wounds have been irrigated or cleansed with hydrogen peroxide, it is possible also to find bubbles of oxygen, which appear on X-ray films as small dark or black spots. These need not be localized to the immediate region of the injury, for the generating oxygen may possess enough force to penetrate the soft tissues for some distance around the wound.

¹Read before the Radiological Society of North America at the Sixteenth Annual Meeting, at Los Angeles, California, Dec. 1-5, 1930.



Fig. 1. Air around the ends of the bone in compound fractures.



Fig. 2. Air in the soft tissues in a crushing injury of the foot.

As an experiment, the track of a pistol bullet through the lower part of the calf of the leg was irrigated with hydrogen peroxide. The liberated oxygen bubbled from the wound with considerable violence and caused severe pain to the patient. On a film made immediately after the irrigation, bubbles of oxygen were found scattered in the soft tissues, both above and below the track, for several inches. They were not present before the ir-

rigation and they disappeared completely within ten hours.

More familiar, perhaps, is the presence of air in the soft tissues of the thorax, neck, and abdominal walls in cases of surgical emphysema in which the lung is injured. Such trauma is associated with fractured ribs or penetrating wounds of the lungs. The parietal and visceral layers of the pleura and the lung must be penetrated. The track

thus formed permits the escape of air from within the lung into the soft tissues. This may continue for some time, the escaping air being distributed mostly in the subcutaneous tissues, often over a wide area of the body. The air is present in the form of round or oval bubbles of various sizes and in the form of layers of various thicknesses under the skin. Only the subcutaneous tissues seem to be involved (Fig. 5). The lax areolar tissue of the axilla and the lower part of the neck is a favorite site for such accumulations.

Surgical emphysema can be readily recognized on X-ray films of the involved areas. The air is best shown in the shadows of those parts of the body through which the rays have passed tangentially to reach the film. That in the axillæ, along the side of the thorax, and along the sides of the neck is clearly shown, while that along the anterior or posterior wall of the thorax is not so distinct. Black or dark oval or circular shadows are caused by the bubbles in the subcutaneous tissues, while the layers of air under the skin and superficial fascia are shown as black streaks. The shadows of the bubbles vary from a few millimeters to as much as four centimeters in diameter; those of the layers vary from fine lines to streaks a centimeter or more in width.

If air is experimentally injected under the skin, it will collect in a thin sheet seen only in a tangential shadow on an X-ray film. If it is injected through the deep fascia into the muscles, it is collected in irregular bubbles which soon become diffused through the muscles and gradually disappear. Rarely will the shadows of air thus produced persist for more than a few hours. Similarly, air accidentally introduced either into the subcutaneous or muscular tissues will soon disappear, unless, as in surgical emphysema, it is being continuously replenished.

Air in the soft tissues causes little discomfort and practically no untoward symptoms.

The small quantities accidentally introduced in fractures, crushing or penetrating wounds, etc., do not cause pain or other trouble. Even the larger amounts resulting from a punctured lung occasion relatively little discomfort. One patient, with two rifle bullets through his left lung, was swollen from his scrotum to his ears as tightly as his skin would permit, yet he had little fever, was not suffering pain, labored respiration being his predominating symptom, and he recovered.

While air in the soft tissues is of little clinical importance, the presence of gas in the tissues as a part of infection with any of the anaërobic gas-producing organisms is of the greatest significance. Mortality in infections of this sort is unusually high, varying from 30 per cent in wounded soldiers during the War to as much as 45 per cent in series reported from civil practice. The earlier the diagnosis and the sooner treatment is instituted in the infection, the better the chances of the patient to recover, and the better the chances for saving him from mutilating operations. Clinically, the condition usually cannot be recognized until the infection is rather advanced. The presence of crepitus, discoloration of the skin, marked swelling, blisters, bubbling of gas from the wound, high temperature, and characteristic odor are all symptoms of a well-established infection. Pain out of proportion to the severity of the injury, swelling, and a copious serosanguineous discharge are perhaps the earliest symptoms. The earliest positive sign of infection with gas-producing organisms is the detection of the gas in the soft tissues as shown by its shadow on roentgenograms.

Probably because of the large numbers of instances that were encountered, the importance of the use of X-rays in gas infections was recognized soon after the beginning of the World War. Martens (15) and Döhner (6) in Germany and Morison (18) in Eng-



Fig. 3. Air incorporated in the portions of the flap in an amputation stump.



Fig. 4. Air in the tissues from a gunshot injury of the thigh.

land seem to have been the first to recognize the shadows of gas on X-ray plates and the fluorescent screen. From the latter part of 1915 on, X-ray examinations were widely used in the army hospitals in Europe in the study of gas infections of wounds, numerous articles on the subject appearing in the German, French, English, and Italian medical literature of that period.

Infections with gas-producing organisms occur in the same type of injuries that are associated with the presence of small quantities of air in the soft tissues. Compound fractures, gunshot injuries, traumatic amputations, crushing injuries, and penetrating wounds of all kinds may be complicated by gas-bacillus infection. Morgan and Vilvan-dré (17) even report one instance of combined surgical emphysema and gas-bacillus infection. The introduction of foreign material, particularly woolen clothing and the

wadding from shotgun shells, increases the likelihood of infection (10), but some of the simplest puncture wounds may be followed by severe types of wound contamination.

Attempts have been made to classify cases of gas infection from the roentgenologic standpoint. Morison (18) and Berry (1) recognize localized and generalized gas infection, the latter being true gas gangrene. Burchard (3) divides the infections into gas abscesses, gas phlegmons, and gas gangrene, a division to which Strauss (21) agrees. These divisions are based on the X-ray appearances of gas infections on X-ray films as found in the examination of wounded soldiers during the World War. Since these patients had to be transported out of the danger zone near the battle front, it is doubtful if any of them was examined early in the course of the infection. For this rea-

son, it seems that in the beginning the condition is one of simple gas-bacillus infection, localized in its extent.

Probably the first stage of an infection with gas-producing bacteria is an edema.

causing necrosis and gangrene. In a gas phlegmon, the gas collects in the interstices of the subcutaneous tissues in the form of irregular, oval, or round bubbles of various sizes, and as sheets or layers of various

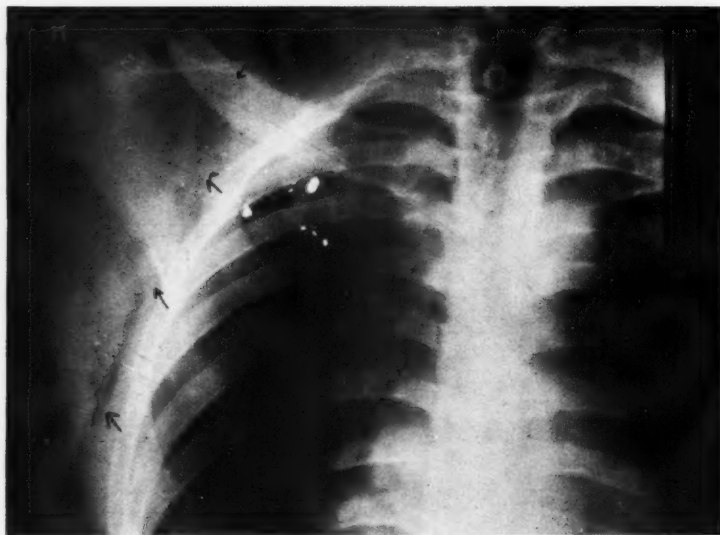


Fig. 5. Surgical emphysema from a gunshot wound of the thorax.

This is soon followed by the production of gas. Early in the infection the gas is collected around the wound of entrance. It forms in small bubbles in the subcutaneous and muscular tissues and as thin layers under the skin and along the fascial planes. If roentgenograms are made of a wound at this stage, the presence of the gas may be identified from its appearance on the films (Figs. 6, 7). The bubbles of gas will cast characteristic dark or black, oval, round, or irregular shadows around the wound of entrance and sometimes in the subcutaneous tissues. If the rays have passed transversely through the gas to reach the film, the layers of gas under the skin will appear as thin, dark streaks.

Later in the infection, the bacilli spread in the subcutaneous tissues, forming a phlegmon, or they grow in the muscular tissues,

thicknesses elevating the skin. In localities where there is considerable loose tissue, as in the popliteal fossæ or axillæ, the accumulations of gas will be larger and more irregular. The appearance of the gas in a gas phlegmon, as shown on an X-ray film, is characteristic. The bubbles cast distinctive shadows and the layers appear as dark or black streaks under the skin. Larger accumulations have a spongy or reticular arrangement. The gas is best shown in transverse views through the region of maximum involvement. Broad streaks on the film indicate an abundance of gas and a serious infection. In Savill's experience (20), infections presenting this X-ray appearance were often fatal and at best required amputation for control (Figs. 8, 9).

Should the wound and the bacteria penetrate the muscles and the infection continue

for any length of time, tissue destruction and necrosis will take place and a true gangrene develop. The process may be in either of two forms. In one, considerable gas develops and collects in a spongy arrangement

shown on roentgenograms of the involved region. In the first, the shadows of the gas have a reticular arrangement, many of the bubbles showing as clearly defined dark or black spots on the films. In the second form,

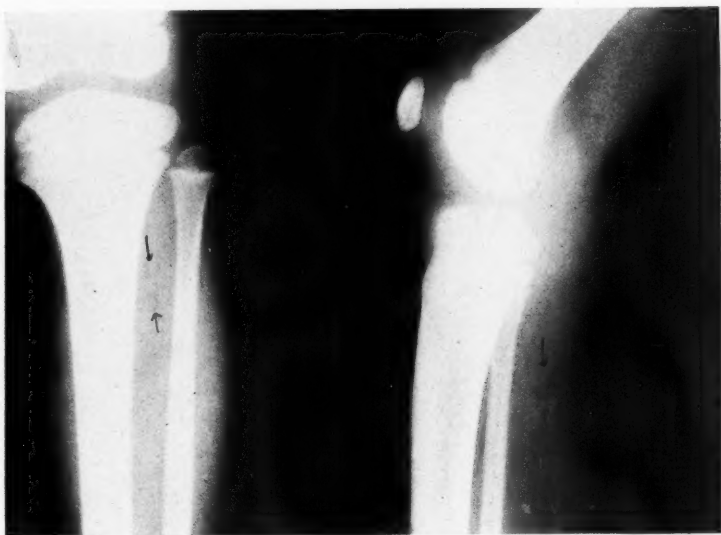


Fig. 6. Early gas-bacillus infection from a puncture wound of the leg. Diagnosis by means of X-ray. These films were made sixteen hours after the accident. The treatment was palliative and recovery was complete without loss of function.

of bubbles replacing the muscle substance. Layers of gas collect along the intermuscular septa and the deep fascial planes. As a result of the action of the products of bacterial growth and the pressure ischemia from the gas, necrosis of the muscle, with liquefaction, occurs. In the other form of gangrene, the gas is less in amount. It collects in thin layers and streaks separating the bundles of muscle fibers, along the intermuscular septa and under the deep fascia. The edema is quite marked. Probably there is not so much destruction of the muscle fibers as in the other form. Should more than one muscle with differently directed fibers be involved, the streaks and layers will accurately follow the direction of the fibers.

Both forms of gas gangrene are easily

the thin layers and streaks of gas show very distinctly, accurately outlining the direction of the muscle fibers. The extent of the involvement of different muscles is recognized from the direction of the lines on the films (Figs. 10, 11). Burchard describes this appearance as being reticulated or feathered.

Lagriffoul and Pech (11), Savill (20), and Burchard (4) made an attempt to differentiate the kinds of infecting organisms from their X-ray appearance. It was their opinion that the form showing as fine lines separating the bundles of muscle fibers was due to the bacillus of malignant edema (*Vibrio septique*) or that this organism was present as a part of the infection. Strauss, however, in a series of infections produced

experimentally came to the conclusion that the differential diagnosis of the type of infection could not be made from the X-ray appearances of the involvement.

The localized gas infection of Morison

wounded in France and brought to England for hospitalization. The injuries had occurred from five to thirty-three days previously. At operation there was no escape of gas noted, yet the *Bacillus Welchii* (per-



Fig. 7. Early gas-bacillus infection from a nail puncture wound of the hand. Diagnosis by means of X-ray. The films were made two and a half hours after the injury. The gas reached the middle of the forearm in twelve hours. Immediate palliative treatment resulted in recovery without loss of function.

and Berry or the gas abscess of Burchard is a type that has been reported only by wartime roentgenologists. It is characterized by a localized accumulation of gas in the soft tissues, usually around a fragment of a projectile, occurring in an infected wound. The gas was found in a large, isolated bubble surrounded by smaller bubbles, but it did not extend proximally or distally into the surrounding tissues. The gas in this type of infection caused distinctive shadows on roentgenograms of the wound regions. Black (2) reported an interesting series of infections of this sort. The gas was found, usually surrounding or adjacent to a projectile, on X-ray examination of soldiers

fringens) was recovered either from the wound or the projectiles. All of the patients recovered.

We have encountered but two possible gas abscesses. One patient had sustained fractures of both heels. One foot became infected and was operated on. Later X-ray examination showed two large radiolucent areas, one surrounding the tuberosity of the os calcis and the other in the soft tissues of the sole. Because of the extensive suppurative osteoarthritis of the foot, an amputation was performed. Recovery was complete. The other patient was a child who had sustained an oblique fracture of the shaft of the femur. An open reduc-



Fig. 8. Gas phlegmon from a compound fracture of the tibia. Diagnosis by means of X-ray. The film was made seven hours after the injury. The extremity was amputated through the lower third of the thigh. The patient recovered.

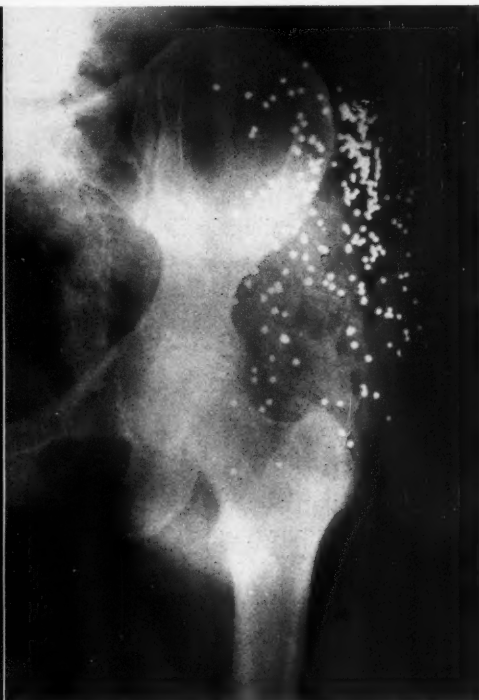


Fig. 9. Gas gangrene from a gunshot injury of the buttocks. Diagnosis by means of X-ray. The film was made eight hours after the accident. The infection spread rapidly and the patient died thirty-six hours after the accident.

tion was done, with the application of a metal band. The wound became infected and suppurated for a considerable period. All except a small fragment of the band was removed. A roentgenogram showed an elongated radiolucent shadow of gas or air in the soft tissues adjacent to the bone. Although it is now over eight months since the injury was sustained, the child has not fully recovered. In neither of these cases was there a bacteriologic examination of material from the wound.

Since the shadows of gas from all forms of gas-bacillus infections are shown so clearly on roentgenograms, X-ray examination should be of great aid in diagnosing the presence of such infection. Many investiga-

tors have emphasized the importance of these examinations, yet other writers and most text-books fail to mention this diagnostic procedure. Christopher (5) emphasizes the importance of the early diagnosis of gas infection and says that roentgenologists should look for gas in every examination of injuries made within ten days of the infliction of the wound. Morgan and Vilvandr  (17), Veronesi (24), Strauss (21), Lardennois, Pech, and Baumel (13), Sprague (22), and others have pointed out the diagnostic importance of X-ray examinations in gas infection. Firor (7) makes the statement that in the early stages of these infections the presence of gas cannot be detected and that in a few an early diag-

nosis can be made by X-ray. Weintrob and Messeloff (23) give three days as the incubation period of gas gangrene and say: "In doubtful or suspicious cases early and repeated roentgen rays may be of value."

By means of experimental infections in guinea pigs, Strauss found that gas was shown on the X-ray films in four hours, and that, if the circulation of the extremity was interrupted by tying the artery, the gas formation was even more rapid. Smaller doses caused gas to be present at the end of eight hours, and in minimal doses, although gas gangrene did not develop, a gas abscess was demonstrable after twenty-four hours.

TABLE I.—INJURIES COMPLICATED BY GAS-BACILLUS INFECTION, A SERIES OF 30 CASES

Compound fractures	9
Gunshot injuries	9
Crushing injuries	6
Penetrating wounds	3
Open reductions	2
Lacerated wounds	1
Total	30

From the records of Little Rock hospitals, I have collected a series of 30 cases of gas infection secondary to compound fractures, gunshot injuries, and other types of penetrating wounds. (Table I).

Seventeen of these had X-ray examinations made of the region of the wound within the first seventy-two hours. The films of 16 showed shadows of gas of diagnostic importance. The X-ray examinations were made from one and a quarter to seventy-two hours after the injury. The film of the patient made one and a quarter hour after the accident, a compound fracture of the forearm, was the single one that did not show the presence of gas. All the others, taken from two and a half to seventy-two hours after the accidents, showed the presence of gas, the average time being twenty and a half hours (Table II):

In 11 of the 16 cases, the diagnosis was made from the study of the X-ray films.

TABLE II.—TIME AFTER THE INJURY THAT 17 OF THE PATIENTS WERE EXAMINED BY MEANS OF X-RAYS

Patients examined by X-ray.....	17
Showing gas	16
Not showing gas.....	1 75 min.
Longest time after injury.....	72 hrs.
Shortest time	2.5 hrs.
Average time	20.5 hrs

These varied from two and a half to seventy-two hours after the injury, with an average time of eighteen and eight-tenths hours. Two of the patients had had operations performed between the time of the accident and the first X-ray examination. One was an amputation of a leg following a crushing injury, the gas being found on an X-ray film of the stump. The other was a comminuted and compound fracture of the bones of the leg. At the operation the fragments were arranged, some of them being removed. If we do not include these two cases, the average time after the accident for the X-ray examination to be positive for the presence of gas is reduced to nine and a half hours (Table III).

TABLE III.—TIME OF THE DIAGNOSES IN THE SERIES OF 30 CASES

Diagnoses made clinically.....	19
Shortest time	12 hrs.
Longest time	75 hrs.
Average	50.5 hrs.
One omitted 14 days	
Diagnoses by X-ray.....	11
Shortest time	2.5 hrs.
Longest time	72 hrs.
Average	18.8 hrs.
Average, omitting 2.....	9.5 hrs.

In 19 of the series of 30 cases, the diagnosis of gas-bacillus infection was made clinically. Eliminating one which did not show gas until fourteen days after a compound fracture, probably a secondary contamination, the shortest time was twelve hours and the longest seventy-five hours, or an average of fifty and a half hours after the injury (Table III).

By comparing the two methods of diagnosis as shown by this series, an average of eighteen and a half hours for X-ray examination, with fifty and a half hours for clinical



Fig. 10. Gas gangrene from a crushing injury of the lateral aspect of the leg. Diagnosis by means of X-ray. Film made ten hours after the injury. The extremity was amputated the following day but the patient died.

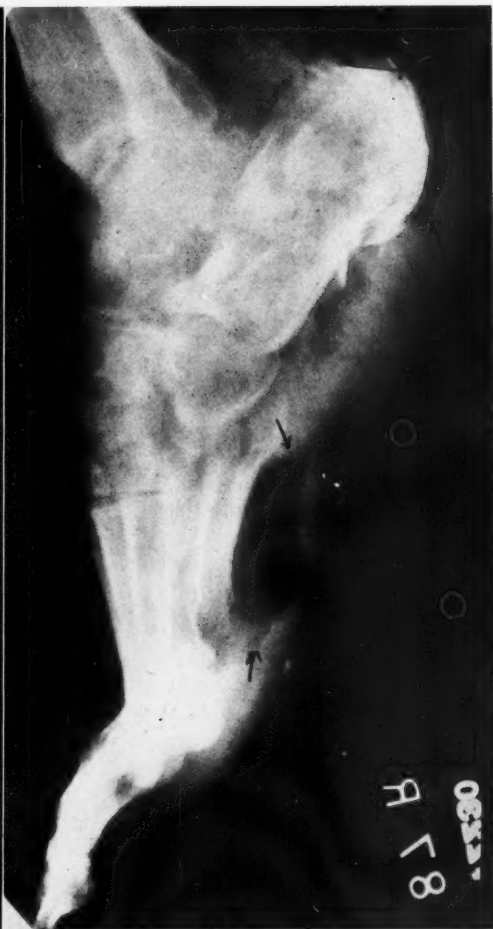


Fig. 11. Showing the characteristics of a gas abscess as described by several writers. A fracture of the heel was followed by a suppurative osteo-arthritis of the foot. The foot was amputated. Laboratory examination for gas-producing organisms was not made.

cal diagnosis, we get an average of more than thirty hours in favor of roentgenographic diagnosis. In a condition that progresses as rapidly and is as serious as gas-bacillus infection, an average delay of over thirty hours in the recognition of the condition and the institution of treatment should be reflected in the mortality. Of the 19 patients diagnosed clinically, 10 died and 9 recovered, a mortality of over 50 per cent,

while but 2 of the 11 cases diagnosed by X-rays died, and other 9 recovering, a mortality rate of about 18 per cent (Table IV).

X-ray examination is also an important aid in the treatment of gas infections. The determination of the kind of infection, whether localized or diffuse, a phlegmon or gangrene, the kind of tissue involved, its depth and extent in an extremity, are all of importance in the selection of the best form

TABLE IV.—COMPARATIVE MORTALITY IN GAS INFECTION FOLLOWING CLINICAL AND X-RAY DIAGNOSES

Number of patients.....		30
Diagnoses made clinically.....	19	
Died	10	
Recovered	9	
Diagnoses by X-ray.....	11	
Died	2	
Recovered	9	

of therapy. In early infections it is possible to locate the incisions and the placement of the irrigating tubes so that the area of the involvement is all included. Patients with such infections treated in this manner, with appropriate doses of antitoxic serum, often recover so promptly that, if bacteriologic confirmation is wanting, the surgeon may even doubt the correctness of the diagnosis. In advanced infections, an intelligent opinion can be formulated as to whether the treatment should be palliative or radical, for, if much gangrenous destruction of muscle tissue be present, valuable time may be wasted in attempting palliative treatment. If amputation is required, the level may be accurately determined. In one case of this series, the infection appeared in the stump, indicating that amputation had been too low. Ledoux-Lebard (14) emphasizes this feature of the X-ray examination of patients with gas infection.

The quality of the roentgenograms taken of wounds that might be infected with gas-producing bacteria may have some bearing on the results of the examination. Those showing considerable detail in the soft tissues are desirable. It is possible to over-expose such films and entirely obscure the shadows of a considerable quantity of gas, yet the films may be of diagnostic quality for the detection of the displacement in compound fractures or the location of foreign bodies in gunshot injuries. If the first films are too dark, a second film should be exposed, particularly to show the soft tissues. If a film is but slightly overexposed, the soft tissues should be examined with a source of light considerably brighter than

the usual viewing illuminator. If these precautions are observed, gas will be found in all instances when it is present.

As small a quantity of air as one cubic centimeter, either in the muscles or under the skin of an extremity, is sufficient to cast a distinct shadow on a properly exposed film. The air in the muscle must not be obscured by the image of the bone or other opaque substance, while, for the detection of the air under the skin, the rays must pass transversely through the layer and show it in profile. A special exposure for the detection of gas is usually not necessary. The customary two views of an injury, as nearly as possible at right-angles to each other, are all that are required. The gas should be looked for along the margins of the image on the film, particularly on that view which shows the injured region in profile.

Some shadows found on X-ray films may be confused with those of gas in the tissues. There are normal, radiolucent areas in the region of the popliteal fossa, around the knee, and behind the ankle. In addition, references have been found to the shadows of bursæ, hematomas, etc. Differentiation must be made, of course, between the shadows caused by air and those of gas, particularly when a surgical emphysema is possible, or when peroxide has been used in treatment. In differentiating surgical emphysema from gas infection, the clinical picture differs so much that a correct decision can be made. If air or oxygen is present, a re-examination after from four to six hours will show no advance in the involvement, while if gas infection is present, the process will be more extensive at the second examination. Sprague (22) advises a re-examination at the end of six hours and says that gas infection will show a definite progression in that time.

SUMMARY

1. Air and oxygen in the soft tissues occur in connection with compound fractures,

gunshot injuries, other types of lacerating and penetrating wounds, in surgical emphysema, and after local treatment with hydrogen peroxide.

2. Gas-bacillus infection occasionally complicates injuries and accidents of the same kinds.

3. The earliest positive diagnostic finding in gas infection is the detection of shadows of the gas on roentgenograms. If made within ten days of the accident, every film of an injury in which the skin is damaged or broken, including the open reduction of fractures, should be carefully examined for the presence of the shadows of gas.

4. The conclusions from X-ray examinations are also of importance in selecting and directing the treatment of gas infections.

5. The early diagnosis and treatment of gas infections materially reduce the mortality.

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DISCUSSION

DR. L. T. LEWALD (New York): I think this is a most remarkable paper. It should stimulate us all to a most careful study of the films of compound fractures or of any wound connected with an injury which we are called upon to radiograph.

I want to ask Dr. Rhinehart if the question of the presence of the bacillus of Welch, which produces this gas, has been demonstrated in most of these cases. Could not an anaerobic culture or animal inoculation with material from the wound be used to make this differential diagnosis between air and the *Bacillus Welchii*?

One other thing I wish to say is that the Welch bacillus is a constant normal inhabitant of the human intestine. I give you that as a

personal experience, because I went to the trouble at one time, at Bellevue Hospital, of having cultures made in routine cases at the hospital morgue. That work was carried out by Dr. Harlow Brooks, Dr. E. K. Dunham, and me. Dr. Dunham at that time was able to demonstrate that spores of these organisms could be brought out on certain substances. As a result of that work we were able to show nearly 100 per cent presence of this organism in the human intestinal tract. That is why it is so easy to get this infection; that is why these gunshot wounds and war wounds are particularly apt to give it. I suppose that the organism is on the skin or is carried in on the clothing, and in that way the infection very readily occurs.

DR. RHINEHART (closing): Some of the cases reported in this series were diagnosed by bacteriologic examination. In some, simple swab cultures have been negative for gas organisms. To be certain that the organisms are present, it is necessary to have the cultures

made from a piece of the involved tissue or from the foreign body.

The differential diagnosis between gas shadows from infection and from air depends on re-examination after a short period. Sprague recommends six hours. In that time, if gas infection is present, there will be an extension of the involvement; if the radiolucent shadows are caused by air, the involvement will be stationary or will regress. If the diagnosis is made early and treatment is promptly instituted, the recovery may be so rapid that the surgeon may doubt the diagnosis.

It is not necessary to have a lacerated wound in order to have a gas infection. In the literature, instances have been reported of infections following hypodermic injections of quinine and digitalis, the organisms probably coming from the patient's skin. One investigator found the *Bacillus Welchii* present in the wadding from shotgun shells, in worn woolen clothing, and even in samples of new clothing obtained from a tailor.

THE EFFECTS OF X-RAYS, CATHODE, AND ULTRA-VIOLET RAYS ON YEAST

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INTRODUCTION

THE following experiments, which form part of a series of quantitative studies of the action of radiation upon simple cells, are intended as a preliminary investigation of the way high velocity electrons, soft X-rays and ultra-violet light de-

days before use in order to bring the cells to a resting stage. Cultures, prepared by spreading a suspension in NaCl of these resting cells upon the surface of the agar medium, were irradiated as soon as dry. After incubation for 24 hours at 22° C. the numbers of single cells and of groups of 2,

TABLE I.—SURVIVAL RATIOS FOR YEAST

For X-rays											
Time (minutes).....	2.5	5	7.5	10	12.5	15	20	25	30	40	
Ratios.....	0.98	.94	.90	.84	.79	.75	.44	.27	.17	.07	
For Cathode Rays											
Time (seconds).....				12	16	24	32	48	60	120	
Ratios.....				0.92	.86	.64	.56	.52	.33	0	
For Ultra-violet Light, $\lambda = 2536 \text{ \AA}$.											
Time (minutes).....				1	1.5	2	3	4	5	6	
Ratios.....				0.95	.91	.65	.50	.42	.34	.24	
For Ultra-violet Light, $\lambda = 2652 \text{ \AA}$.											
Time (minutes).....					$\frac{5}{8}$	$\frac{3}{4}$	1	$1\frac{1}{8}$	$1\frac{1}{4}$	$2\frac{1}{2}$	
Ratios.....					0.92	.86	.60	.44	.38	.16	
For Ultra-violet Light, $\lambda = 2900 \text{ \AA}$.											
Time (minutes).....				3	4	5	6	7.5	10	12.5	15
Ratios.....				0.99	.89	.72	.72	.62	.49	.31	.17
For Ultra-violet Light, $\lambda = 3132 \text{ \AA}$.											
Time (minutes).....					15	20	25	30	35	40	
Ratios.....					0.87	.59	.34	.15	.12	.05	

stroy yeast. Besides early observations¹ of a qualitative character, some quantitative measurements² bearing upon this problem have recently been described. In so far as they can be compared, our data, which were at hand before these others appeared, are in substantial agreement with them.

TECHNIC

A parent culture of *Saccharomyces cerevisiae* (Variety 40) was obtained from the Fleischmann Laboratory. Transplants upon Naegeli's agar medium were carried fifteen

3-4, 5-8 and of more than eight cells within a selected area were ascertained. In other experiments survival ratios were found by counts of the total number of living cells using eosin staining as an index of cell death. Series of control cultures also were seeded and counted after incubation to determine the percentage of cells which failed to develop without irradiation. All results have been calculated with the corrections provided by these controls.

The experimental arrangement for the production, application and measurement of the copper X-rays ($\lambda = 1.537 \text{ \AA}$) used in these studies has already been described.³ Though the dose was not accurately measured in these preliminary experiments, the

¹Martinand, Compt. rend., 1871, CXIII; Buchta, Cent. Bakt., II, 1914, XLI, 340; M. von Recklinghausen, Jour. Am. Water Works Assn., 1914, I, 565; G. Madson and G. Philippov, Compt. rend. Soc. biol., 1928, XCVIII, 366.

²A. Lacassagne, Compt. rend., 1930, CXC, 524; F. Holweck, ibid., 1930, CXC, 52; F. Holweck and A. Lacassagne, Compt. rend. Soc. biol., 1930, CIII, 60; A. Lacassagne and F. Holweck, ibid., 1930, CIV, 1221.

TABLE II.—COUNTS SHOWING GROWTH OF IRRADIATED YEAST CELLS

With X-rays													
No. cells in colony	Time in minutes												
	0	5	10	15	20	25	30	35	40	45	50	55	60
1	23%	17%	19%	22%	26%	28%	34%	37%	40%	65%	78%	87%	94%
2	6	8	19	36	55	59	51	52	43	30	15	9	4
3-4	16	23	21	19	11	10	11	9	13	4	5	4	2
5-8	42	46	34	19	8	3	5	2	4	1	1	0	0
>8	13	6	6	4	2	0	0	0	0	0	0	0	0
With Cathode Rays													
No. cells in colony	Time in seconds												
	0	1	2	4	8	12	16	24	32	48	60		
1	3%	5%	3%	3%	1%	11%	17%	38%	45%	49%	69%		
2	3	9	33	31	80	82	77	58	51	38	23		
3-4	12	25	23	19	13	6	5	5	4	13	8		
5-8	41	43	30	28	4	1	1	0	0	0	0		
>8	41	17	10	18	2	0	0	0	0	0	0		
With Ultra-violet Light, $\lambda = 2536 \text{ \AA}$.													
No. cells in colony	Time in minutes												
	0	1/2	1	1 1/2	2	3	4	5	10	15			
1	9%	5%	14%	16%	40%	52%	61%	69%	75%	90%			
2	4	8	20	27	23	24	20	17	15	7			
3-4	15	24	16	15	11	12	9	8	8	2			
5-8	38	41	31	22	12	8	7	4	2	0			
>8	35	22	19	20	14	4	2	1	0	0			
With Ultra-violet Light, $\lambda = 2652 \text{ \AA}$.													
No. cells in colony	Time in minutes												
	0	3/8	1/2	5/8	1	1 1/4	2 1/2						
1	35%	28%	26%	36%	59%	74%	90%						
2	5	7	9	23	19	17	9						
3-4	3	7	6	8	8	6	1						
5-8	9	12	12	12	6	1	0						
>8	49	46	47	21	9	1	0						
With Ultra-violet Light, $\lambda = 2900 \text{ \AA}$.													
No. cells in colony	Time in minutes												
	0	1/2	1	1 1/2	2	3	5	7					
1	11%	8%	8%	23%	37%	66%	79%	85%					
2	5	5	8	22	25	19	15	11					
3-4	6	4	5	13	13	8	4	3					
5-8	25	30	21	28	17	5	1	1					
>8	53	52	58	14	7	2	0	0					
With Ultra-violet Light, $\lambda = 3132 \text{ \AA}$.													
No. cells in colony	Time in minutes												
	0	2	4	6	10	15	20						
1	12%	11%	22%	38%	58%	84%	84%						
2	9	3	13	22	20	10	11						
3-4	7	3	10	14	10	3	4						
5-8	10	6	15	14	6	1	1						
>8	62	77	39	12	7	2	0						

air ionization they caused at the irradiated surface was approximately 130 e.s.u. cm.²/second.

Cathode rays were obtained from a Coolidge type cathode-ray tube. The conditions of its operation, the disposition of the test material during exposure and the approxi-

mate dose were the same as during previous experiments⁴ on bacteria.

Monochromatic ultra-violet light was provided by a large quartz mercury arc and a monochromator with lenses about five inches in diameter and prisms of the same height. By proper focusing, individual spectral lines

²R. W. G. Wyckoff, Jour. Exp. Med., 1930, LII, 435, 769.

⁴R. W. G. Wyckoff and T. M. Rivers, Jour. Exp. Med., 1930, LI, 921.

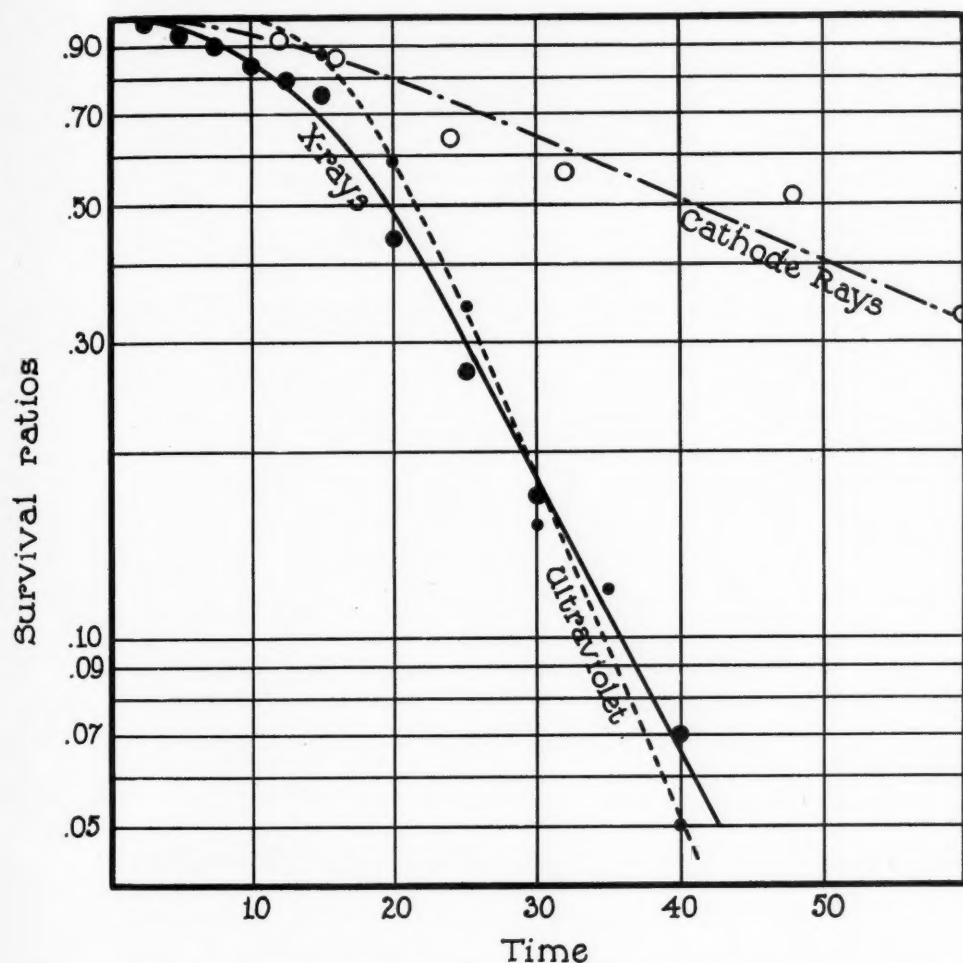


Fig. 1. Some observed survival ratios for yeast. Data with X-rays and with ultra-violet ($\lambda = 2900$ Å.) light are shown as large and small black dots, observations with cathode rays are plotted as open circles. For the first two the abscissas are in minutes, for the last they are seconds.

could be made to fill completely and uniformly an area, 4 mm. \times 20 mm., which was marked upon the agar plate by a cutting edge similar to that described for the previous experiments.⁵ The energy in the beam striking the surface of the agar could be found by replacing the cutting edge with a calibrated thermopile. Accurate measurements were not made during these exploratory observations but for the four wave lengths used the incident energies were

roughly the following: for 2,536 Å., 8 ergs/mm.²/sec.; for 2,652 Å., 9 ergs/mm.²/sec.; for 2,900 Å., 11 ergs/mm.²/sec.; for 3,132 Å., 48 ergs/mm.²/second.

Final counts of the several categories of cell growth for the different radiations are collected in Tables I and II. Each point is the average of two or more experiments which involve the enumeration of at least 3,000 irradiated cells.

Control irradiations of culture medium with doses far in excess of those needed in

⁵R. W. G. Wyckoff and T. M. Rivers, *op. cit.*

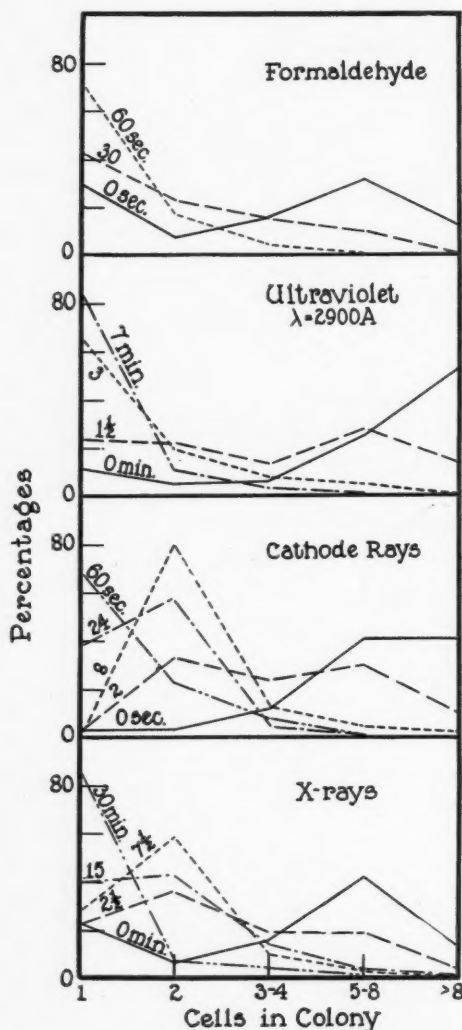


Fig. 2. Plots of some of the data of Table II showing the abnormally large numbers of two-celled colonies which develop under X- and cathode rays, and their absence with ultra-violet light and formaldehyde.

these experiments demonstrated that the destructive action of the radiations is directly upon the cells themselves and not upon their food material.

DISCUSSION

Plotted on a semi-logarithmic scale (Fig. 1) the survival ratios, with each

type of radiation follow a multiple hit-to-kill curve. The progressive stages of injury suggested by these curves and clearly indicated by the data of Table II make it difficult to set up a precise criterion of lethal action. For this reason our results probably are not yet of sufficient absolute accuracy to give a real meaning to the customary calculations of the number of hits-to-kill and of sensitive volumes.

The most striking effect of X-rays on yeast is the development of large numbers of two-cell colonies (Fig. 2). The percentage of irradiated yeast cells which can go through one budding but no more is even higher if cathode rays are used. With ultraviolet light (Fig. 2) this "two-cell effect" does not occur. Neither is it found in cultures exposed under the same conditions to the vapors of formaldehyde (Fig. 2). This specific action of cathode and X-rays is evidently due to their injury of some factor essential to reproduction, but the present experiments give no idea why cells thus affected should be able to bud once. It would be natural to assume that divisions which had begun at the moment of irradiation could go to completion but that new buds could not form. A careful consideration of the data of this paper does not, however, seem to satisfy such an hypothesis.

As with higher organisms subjected to X-radiation, yeast loses its ability to multiply long before it is killed. Cells belonging to both the single and two-celled colonies live on in an apparently healthy condition for days. A consequence of this continued life and growth without multiplication is the development of many giant cells, similar to those found in irradiated tissues of various sorts.

SUMMARY

Preliminary results are recorded of the effects of X-rays, cathode rays, and monochromatic ultra-violet light upon yeast (*Saccharomyces cerevisiae*). Survival ratios

with all these radiations follow multiple hit-to-kill relations of similar slopes.

In accordance with this conclusion it is observed that, apparently unlike bacteria, yeasts can be injured without being killed outright. With ultra-violet light these injuries show themselves in a slowing up of the growth rate of irradiated cells. The four wave lengths used exhibit differences which are undoubtedly due only to their relative intensities and absorptions within the yeast cells.

Injury with either cathode rays or X-rays is followed by the development of an extraordinarily large number of two-celled

colonies which on prolonged incubation ultimately die without further budding. As with many more highly organized cells, it is apparent that the reproductive function is disturbed by the absorption of an amount of X-radiation far too small to bring about direct and immediate death.

The destructive action of formaldehyde resembles that of ultra-violet light. Yeast exposed to the vapors of this chemical does not show an abnormal number of two-celled colonies.

These experiments give no indication that small doses of radiation have any stimulative effects upon the growth of yeast.

LINITIS PLASTICA¹

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WHILE not voluminous, the literature on linitis plastica is decidedly controversial in the opinions expressed as to the exact nature and interpretation of the underlying pathologic process. The descriptive term, coined by Brinton in 1854, refers to and describes the delicate and interlacing connective tissue fibers so peculiar and characteristic of the condition. Lyle (45) mentions 21 terms used by different authors to designate the condition, which serves to illustrate the different views which have been held. These terms are all employed to identify a pathologic process in which the stomach walls are thickened and hardened, involving a greater or lesser portion of the organ, usually producing a diminution in its capacity.

The literature subsequent to Lyle's excellent article in 1911 has been reviewed in an attempt to evaluate the present trend of thought as to the exact pathologic process involved. One hundred and thirty-eight cases were reviewed, of which the authors classed 95 as malignant and 38 as benign, including those considered as due to syphilis. In 6, the nature of the process was not stated. Sex was given in 131 cases, there being 69 males and 62 females, a finding at variance with previous reports which have considered males to be affected twice as frequently as females. While the ages ranged from 10 to 71, the greater majority occurred in from the fourth to the sixth decade.

The disease has no symptomatology of its own and those presented are due to a gradual loss of the normal function of the stomach from a slow decrease in its size

and the development of cardiac or pyloric stenosis, usually the latter. The onset is insidious: dyspepsia with eructations of gas, dysphagia, epigastric pain, at first irregular vomiting, which later becomes more frequent, indicating the diminishing capacity of the stomach. Jacques, cited in Singer's article (Series B, Case 19), was able to make a diagnosis on the character of the vomitus. The symptoms may persist over a period of years, long duration being the rule, although a few cases are reported as relatively sudden in their onset.

In 62 cases, a palpable tumor was noted in the abdomen, usually in the epigastric region, while in 17 other cases a sense of resistance was mentioned as being present. Achylia, with decreased total acidity, is commonly found together with a moderate secondary anemia. Hematemesis and blood in the stools are rare findings.

The most important single examination is the X-ray examination, which reveals the characteristic picture of a diminished lumen, rigid walls (absence of peristalsis and incompressibility of the organ), patent pylorus, and rapid emptying. Definitely conclusive findings were reported in 29 cases, while a possible roentgenologic diagnosis was made in 8 others. However, the X-ray examination can give only the characteristic gross deformity associated with the condition as suggested by LeWald (42); the final opinion rests with the pathologist.

There has been much speculation as to the etiologic factors involved, the opinions of most authors having been divided between the inflammatory and neoplastic origins of the process. Singer (73, 74), Faroy (29), Landau (40) and LeWald cite cases in which the assumption of a

¹Read before the Radiological Society of North America at the Sixteenth Annual Meeting, at Los Angeles, Dec. 1-5, 1930.

syphilitic etiology appears tenable. It is possible that syphilis plays a part in the production of the lesion, at least in the earlier stages, but malignant transformation is the usual course. The inflammatory theory is worthy of consideration because chronic inflammatory processes are known to have a part in the production of cancer. Chronic gastritis, ulcer, or epithelioma may inaugurate the connective tissue proliferation. Armstrong (5) states that this fibromatosis may be considered as having a tendency to become malignant. Thomson and Graham (81) are positive that fibromatosis as described may occur without the presence of cancer, a view shared by Dwight (25), Wyard (88) and others. Vecchi (84) felt that the hyperplastic reaction of the connective tissue, which constitutes the macroscopical picture, is strictly connected in his cases with the presence and development of the neoplasm. This is the opinion of the majority of the recent writers.

The gross anatomic appearance is essentially a diffuse thickening of the gastric walls from a development of fibrous connective tissue, being especially marked in the submucosa. From this layer, the tissue spreads into the subserosa. This finding is characteristic, whatever the histologic examination may reveal of the nature of the cells. The lesion may be localized or it may involve the entire organ. The generalized form is a late stage of the local lesion. The walls exhibit marked thickening and a lack of flexibility with loss of the normal glistening appearance of the overlying peritoneum. The fundamental lesion is the enormous development of fibrous tissue in the submucosa, which may invade the subserosa, peritoneum, and adjoining organs.

Histologically, linitis plastica is a process in which there is a very dense, small, round-cell infiltration of the lower parts of the mucosa and the upper layers of the submucosa, exhibiting a marked tendency to

the formation of fibrous tissue. The muscular elements, which show marked hypertrophy, are interspersed with the bands of this connective tissue proliferation extending in from the submucosa. The subserosa is thickened from the same cause. Thus it is seen that we are dealing with connective tissue sclerosis of the submucosa and subserosa. Of greatest importance in the determination of the nature of the process is the identification of the cells found in this connective tissue network. These, which resemble epithelial cells, are found more or less widely scattered and arranged in groups, or as isolated elements. Many authors have emphasized the degenerated appearance of these cells, among them being Ewing (28), Baumgartner (13), and Vecchi (84). Practically every writer has mentioned these cells but the interpretations of origin are widely divergent. Mitotic figures are not frequent. It is not surprising that in this dense, fibrous tissue the most careful microscopic examination is required to determine the presence of cancerous cells. Invariably many sections must be studied before they are identified as cancerous. Cases are on record in which an unsuccessful attempt has been made to find malignant cells in the gastric walls but, on examination of the regional lymph nodes, carcinoma metastases were found (Behring, Series A, Case 9). There are other cases in which the pathologic diagnosis was that of benign tumor, the patient later dying of metastatic carcinoma (Holding, Series B, Case 11). In other cases, a diagnosis of benign tumor has been changed to malignancy on further examination of the sections, as by Lyons (46) in 6 cases, McMahon (51), and Plettner (63).

Lyle collected 130 cases of which 60 were obviously scirrhus carcinomas, a proportion which runs even higher in this series. Faroy (29) observed the coexistence of linitis and scirrhus cancer with transitions between these two lesions. He assumes that the can-

cerous cells in the midst of the linitic tissue would imply that the linitis passes through a stage of more or less typical scirrhus carcinoma before reaching the histologic stage by which it is identified. It is interesting and important to note that the age incidence is practically the same in the group reported as malignant as in that reported as benign, which adds weight to the argument that some, and perhaps many, of the cases reported as benign were really malignant. By some observers, the cells found in the submucosa are regarded as endothelial in origin from the lining of the normal lymph spaces. Even then they should be considered at least as a newgrowth, if not actually malignant. Several cases of linitis plastica with metastases in other parts of the alimentary canal have been described, the extension along the lymphatics—another analogy with cancer—being demonstrated strikingly in Cesa-Bianchi's case (20).

Under the term, a variety of processes has been described. When unmistakable epithelial malignant elements are conspicuous, the genesis of the condition is clear and the presence of cancer definitely established. There is a group of cases, however, in which the histologic distinction between the inflammatory and neoplastic lesions is difficult to draw. That cancer cells may be reduced to widely scattered islands or even to isolated cells in the dense connective tissue stroma has probably led to the inclusion of many scirrhus carcinomas in the benign group. The absence of malignant cells over a considerable area of the stomach has led to the assumption that, in the majority of cases, linitis plastica is the result of a healed or almost healed disseminated fibrocarcinoma (Andresen, 4, Konjetzny, 39). However, it is evident from the work of Thomson and Graham (81) that fibromatosis, whatever the histologic diagnosis, may occur without the presence of cancer.

Linitis plastica is an atypical fibrocar-

cinoma. It is characterized by extensive gross and microscopic pathologic increase of connective tissue involving the tunics of the gastric walls, but more marked in the submucosa and in the muscularis with frequently only isolated cells of a malignant nature. The term is worthy of retention as descriptive of the gross deformity, but, from the pathologic viewpoint, the classification of Dwight (25) as either fibromatosis or carcinoma, diffuse or local in its extent, is considered more suitable.

The following case is reported through the courtesy of Dr. Arthur F. Hoge.

The patient, W. C. C., a male, aged 39, was admitted June 9, 1930, complaining of pain in the abdomen which had begun about one year previously. About four months before the present examination the pain, which was located in the epigastrium and was of a sharp, cutting type, increased in severity, occurring shortly after the patient began to eat. Nausea, with infrequent vomiting, without blood or belching, is associated with the attacks of pain. The eructation of gas has given relief at times. There has been a loss of about 26 pounds during the preceding six months. There is tenderness and moderate muscle-guarding across the upper abdomen, with a suggestion of a mass, which can not be well mapped out, in the right hypochondrium.

The blood examination was positive for tertian malaria, with 4,300,000 red cells, 7,000 white cells, 86 per cent hemoglobin, and 66 per cent neutrophils. The feces were negative for parasites, ova, or occult blood. Urinalysis was negative. On X-ray examination, it was noted that the barium meal was "dumped" through the stomach into the duodenum and passed rapidly beyond. The upper portion of the stomach was tubular, without visible peristalsis or normal flexibility of the walls. The X-ray diagnosis was linitis plastica (Fig. 1).

Comment (Dr. A. F. Hoge).—We have

here a patient who presents from the roentgenologic findings perfect evidence of linitis plastica. There is no evidence of metastases shown and, while the stomach involvement is extensive, it is hoped that there may be no metastases found. Since the patient's general condition is good, a total gastrectomy can be accomplished. The situation has been explained to the patient and he is desirous of having the exploratory operation performed.

Operation (June 12, 1930).—Exploratory laparotomy under sodium amytal intravenously with supplementary novocain infiltration. On opening the peritoneum, about 2 quarts of amber-colored fluid were found and removed by aspiration. The stomach was a hard, infiltrated mass (leather bottle type). The infiltration extended up to the esophageal opening and downward to the pylorus. There were hard, nodular glands in the hepatic pouch and around the portal vessels. The gastrocolic omentum was infiltrated and hard, as was the transverse colon, which contained within its walls a hard, cancerous mass about the size of an egg. The intestines were diffusely studded with small, hard nodules. In view of the general metastases, no attempt was made at radical removal and the abdomen was closed. The patient had an uneventful operative recovery and was discharged from the hospital on the ninth post-operative day. He died in September, 1930. The autopsy which had been planned could not be carried out, and the histologic study of sections could not be given.

SERIES A.—CASES REPORTED AS MALIGNANT

1. *A. H. Aaron and J. V. Wadsworth (1)*

Male, age 31 years. "Soft" chancre 12 years previous to examination, with 12 negative Wassermanns since then; hard mass lying transversely, palpable in epigastrium, varying in size with visible peristalsis. X-ray examination showed: large prepyloric



Fig. 1. Case 1. The barium meal was "dumped" through the stomach into the duodenum and passed rapidly beyond. The upper portion of the stomach was tubular, without visible peristalsis or normal flexibility of the walls. The X-ray diagnosis was linitis plastica.

filling defect, constant after anti-spasmodics. Gastrostomy followed by progressive emaciation. Jejunostomy was also unsatisfactory. Posterior gastro-enterostomy performed but the patient died one week later. The stomach was diminished in size, with thickened walls, but with no metastatic lesions. Histologic examination showed: extreme fibrosis affecting all coats, especially submucosa, with peculiar large cells, identified as degenerated epithelial cells, representative of carcinoma.

2. *G. Albot and L. Michaux (2)*

Female, age 46 years. Coexistent acanthosis nigricans, presenting rapid generalization of cancer, papillomas on mouth and skin of eyelids, ascites, and pleural fluid collection. The patient died in two

weeks. Histologic examination showed: latent epithelioma of linitis plastica type, ulceration of mucosa, the epithelioma giving rise to the metastases. Autopsy revealed many large glandular masses about the pancreas; intestines normal; stomach walls soft except for cicatricial area resembling ulcer on lesser curvature; tumor masses in both ovaries, but none in liver, spleen, or uterus.

3. *C. Achard, J. Mouzon, and G. Marchal* (8)

Female, age 63 years. Ascites and constricting rectal ring found, diagnosed as cancer of rectum with extensions to peritoneum. The patient died in three weeks. Histologic examination showed: linitic infiltration of submucosa, extending to peritoneum, ileum, and rectum; malignant. Autopsy revealed three gallons of ascitic fluid; white and hard areas on the peritoneum; stomach hard, retracted, and indurated, adhering to deeper structures; similar lesions in intestines; constriction rings in terminal ileum; rectum infiltrated.

4. *A. F. R. Andresen* (4)

Female, age 57 years. Autopsy revealed all layers of stomach uniformly and completely invaded by medullary carcinoma.

5. *L. Babonneix, J. Brisard, and J. Blum* (9)

Female, age 51 years. X-ray examination showed: stomach small and retracted, walls inert and fixed, rapid emptying, no visible peristalsis. Death by cachexia in one month. Histologic examination showed: stomach walls massively infiltrated with epitheliomatous elements of a cancerous type, invading mesentery; subhepatic peritoneum and ovary showed considerable thickening of gastric tunics, especially submucosa; periarteritis and endarteritis. Autopsy revealed: stomach, small, extremely thick walls, covered with inflammatory substance,

extending to neighboring organs; uterus fibromatic.

6. *L. Babonneix and Vigot* (10)

Female, age 59 years. Clinical evidence of syphilis but negative Wassermann. The patient died in three months. Histologic examination showed: Typical colloid cancerous degeneration. The authors felt that syphilis played a rôle in the production of the lesions. Autopsy revealed: stomach small, retracted, marked limitation of capacity, walls thickened; peritoneal inflammatory lesions.

7. *G. M. Barrett* (12)

Female, age 39 years. Upon X-ray examination the stomach appeared as a narrow, tubular, rapidly emptying organ. At operation the stomach appeared to be involved in a malignant growth; transverse colon was thick and hard. The patient died two days later. Histologic examination showed the muscle wall to be studded with cancer cells; the transverse colon showed the same changes; scirrhus cancer.

8. *E. A. Baumgartner, C. E. Case, and J. K. Deegan* (13)

Case 1. Gastric resection was done and posterior gastro-enterostomy. The patient died suddenly sixteen months later from an unknown cause.

Case 2. Gastric resection was done and gastro-jejunostomy. The patient died four hours later.

Case 3. Gastric resection was done and posterior gastro-enterostomy. The patient died on the fifth day.

Case 4. Exploratory operation was done but the case was found inoperable. The patient died two days later.

Case 5. Exploratory operation was done

but the case was found inoperable. The patient died ten days later.

In all cases histologic examination was made of removed specimens which showed the cellular infiltration characteristic of the cancerous type. Of the cases cited three were males; the age range was from 65 to 47. Four of the cases were diagnosed preoperatively as cancer and one as ulcer.

The authors feel that the most important single examination is the X-ray and they call attention to the value of special mucin staining to demonstrate mucous cells displaced from the digestive tract, undergoing metaplasia and cancerous degeneration (*vide Vecchi infra*).

9. I. Behring (15)

Females, ages 50, 55, and 60 years. The preliminary histologic examination showed a benign condition, but further examination revealed the presence of cancer, as in McMahon's case (No. 24 *infra*.) In one case, the examination of the regional lymph nodes was indispensable for diagnosis; in the third case, a detailed examination of the gastric wall proved conclusive, while the examination of the lymph glands was negative.

10. J. Bland-Sutton (17)

Female, age 42 years. Marked ascites, clinically thought to be cancerous. Exploratory laparotomy revealed typical leather bottle stomach so intimately adherent that hopeful surgery was out of the question. The patient died three weeks later. Histologic examination showed infiltration of the coats with spheroid-cell carcinoma. Autopsy revealed the stomach walls thickened and rigid and the capacity decreased. In a second case, total gastrectomy was performed and the patient lived three and one-half years. The cause of death is not known. The microscopic diagnosis was cancer but the author feels

that this was a benign condition, a localized linitis plastica.

11. A. L. Busacchi (18)

Malignant linitis plastica in which the histologic examination showed a local eosinophilia, the distribution of which was entirely different from that usually occurring in morbid stomach processes. The eosinophils were more numerous in the submucosa than in the other tunics and were intimately associated with the neoplastic epithelial cells.

12. E. Chambard (21)

Female, age 69 years. Hard, prerectal mass, thought to be a neoplasm, was noted. Operation disclosed the great omentum retracted into hard cord, peritoneum thick and hard, sigmoid thick and rigid. Lateral ileac anus was made but the patient died a few days later. Histologic examination showed diffuse epithelial proliferation, diffuse linitic cancer of stomach and peritoneum. Autopsy revealed chronic generalized fibrous peritonitis, classical linitic stomach, small intestine contracted, liver and pancreas sclerous.

13. Deve (24)

Male, age 68 years. Repeated paracentesis was carried out for ascites. The patient died seven months later. No histologic examination was made. Autopsy revealed hemorrhagic peritonitis without a single secondary nodule in liver, glands, or lungs; stomach retracted with thickened, rigid walls, cancerous infiltration in right ileac region of abdominal wall.

14. O. Ehni and F. Loup (26)

Case 1. Male, age 49 years. Palpable tumor in epigastrium; stomach admitted from 100 to 150 c.c. only of fluid by lavage.

Clinical diagnosis of cancer was changed to linitis because of reduction in capacity. The patient died four months later. No histologic examination was made. Autopsy revealed walls of stomach very thick, capacity about 100 c.c.; diffuse carcinoma of stomach; surrounding glands cancerous; cancer of peritoneum with ascites.

Case 2. Female, age 62 years. Diagnosed stenosis of stomach and jejunostomy performed. The woman died one month later. Histologic examination showed small epithelial cells scattered in the interstices of the hypertrophied connective tissue and submucosa; scirrhus carcinoma of stomach; generalized plastic linitis. Autopsy revealed the stomach small with uniform thickening of the walls.

15. *G. Faroy* (29)

Case 1. Male, age 47 years. X-ray examination showed stomach small without peristalsis, pyloric incontinence, suggesting diagnosis of linitis plastica. The man died on the fourteenth day. Histologic examination showed linitic neoplastic lesions in all stomach coats; arteritis and endarteritis; cirrhosis of the liver, differing from the usual type by localization around arteries, veins, excretory ducts, and at height of the portal clefts; linitic invasion of upper duodenum and lymphatic ganglia; invasion of pancreas with neoplastic process; neoplastic cells in thrombosed vein of portal system. Autopsy revealed small, retracted stomach with infiltrated walls; cirrhosis of the liver.

Case 2. Male, age 63 years. X-ray examination disclosed dilated, elongated stomach, distended pyloric antrum, but no passage into duodenum despite violent peristalsis. Diagnosed pyloric stenosis of neoplastic origin. An anterior gastro-enterostomy was done but death ensued a few hours later. Histologic examination showed muscularis pervaded with neoplastic epithe-

lial cells; muscularis and submucosa showed typical linitic tissue; invasion of lymphatic ganglia. Autopsy revealed neoplastic process which affected pylorus and adjoining lesser curvature with inseparable adhesions of these structures to liver.

Case 3. Female, age 33 years. X-ray examination showed ptosis of stomach, adhesions of pylorus to right. There was no improvement under mercurial treatment, therefore, a posterior gastro-enterostomy was performed during which a mobile mass was found in the pyloric region. The patient died one day later. Histologic examination showed typical linitis and scirrhus cancer in the antrum (submucosa). Autopsy revealed the walls of the pylorus thickened and the stomach dilated.

The author calls attention to the coexistence of linitis plastica and scirrhus cancer in all three cases but feels that the affection of the arterial coats is proof of the syphilitic pathogenesis of linitis. Two of the cases were averred syphilitics. The author believes that linitis is cancer, given its characteristic features by syphilis, which, although not reported as the cause of all the cases, is always at the bottom of this affection and would be found if more diligent search were made.

16. *B. W. Fontaine* (30)

Female, age 44 years. X-ray examination showed stomach small and funnel-shaped without peristalsis, rapid emptying into duodenum. Diagnosed as syphilis and treated for one month without improvement; subsequently checked at monthly intervals and doing well. This was considered a slow-growing scirrhus carcinoma, producing malignant linitis plastica. No further report was obtainable.

17. *W. Goldschmidt* (33)

Female, age 45 years. X-ray examination showed extensive cirrhosis of stomach,

pylorus patent, rapid emptying. Subtotal gastrectomy, with gastro-jejunostomy was performed, disclosing the pyloric portion transformed into a hard, cylindrical shape and total infiltration of the stomach. The woman was discharged in three weeks. No further report is given. Histologic examination showed infiltrating carcinoma with tendency to gelatinous degeneration with similiar picture in lymph glands.

18. *A. Huquier* (37)

Female, age 31 years. X-ray examination showed rapid emptying, ulcer. Subtotal gastrectomy with anterior gastro-enterostomy for suspected carcinoma was done. The patient was well one year later. Histologic examination showed the usual lesions of linitis with neoplastic cells more numerous than those of the fibrous type.

19. *Richet Le Noir and Langle* (41)

Male, age 30 years. X-ray examination showed the stomach fixed by perigastric adhesions. The man died eight days later. Histologic study disclosed cancerous linitis plastica. Autopsy revealed cancerous lesions in many organs, the point of departure being a plastic linitis; stomach buried in thick, firm adhesions; walls thick and hard; secondary nodules in liver; miliary cancerous growths in lungs.

20. *L. T. LeWald* (42)

Five cases: three malignant, one benign, and one syphilitic (Series B, No. 10).

Case 3. Female, age 23 years. X-ray examination showed immediate passage of barium meal, small stomach, gaping pylorus, resembling syphilis. Operated under probable diagnosis of carcinoma of stomach or splenomegalia. The walls of the stomach were found thickened and contracted. Jejunostomy was performed but the patient died two weeks after the operation. His-

tologic study disclosed carcinoma in the inflammatory tissue.

Case 4. Male, age 56 years. X-ray examination showed remarkably small stomach, gaping pylorus, secondary dilatation of esophagus, typical leather bottle stomach but closely resembling syphilitic infiltration of stomach. Exploratory laparotomy disclosed extensive adhesions of stomach, intestines, and colon; stomach and colon infiltrated with newgrowth; primary seat of tumor not determined; liver studded with metastatic nodules. Histologic study revealed metastatic carcinoma from the abdomen.

Case 5. Female, age 63 years. X-ray examination showed exceedingly small stomach, dumb-bell-shaped, gaping pylorus, slight dilatation of esophagus, moderate dilatation of duodenum; diagnosed leather bottle stomach. Jejunostomy revealed the stomach greatly reduced in size and the walls extensively involved in apparent diffuse carcinoma. There were no secondary nodules. No histologic examination was made.

21. *J. H. Lyons* (46)

This is a report on 38 cases studied at the Mayo Clinic in which the diagnosis was made at operation. Twenty-five specimens were obtained at operation for study; fourteen were diagnosed as small-cell carcinoma; six others were first considered non-malignant, but, the patients dying shortly after the operation, the specimens were further studied and small-cell carcinoma revealed in all. In the remaining 5 cases, the microscopic diagnosis was syphilis, simple muscular hypertrophy, simple gastric ulcer, adenocarcinoma, and colloid carcinoma. The ages ranged from 71 to 34, the number of males being twice that of the females.

22. *J. Martinez* (47)

Three cases; one malignant and two benign (Series B, No. 14).

Case 3. Female, age 57 years. X-ray examination showed stomach small and rigid, rapid emptying without peristalsis. Diagnosed carcinoma. Exploratory laparotomy showed the stomach rigid in a circumscribed area; large omentum one large, rigid, granulous, infiltrated mass. The woman died two months later. No histologic examination was made.

23. *C. Massias and G. Auriat* (48)

The patient, male, aged 72 years, died of progressive cachexia after periods of painless regurgitation during many years. Histologic examination showed submucosa thickened by connective tissue containing numerous collections of epithelial cell islets, atypical, polymorphic, cancerous. Autopsy revealed stomach small, hard, resistive to knife; transverse mesocolon adherent and thickened.

24. *F. B. McMahon* (51)

Female, age 49 years. X-ray examination showed a large filling defect in the pyloric region with retention. Diagnosed pyloric obstruction, probably malignant. Partial gastrectomy for hard, rounded pyloric tumor, with Balfour anterior gastro-enterostomy and jejunostomy, was performed. Grossly typical of linitis plastica. Histologic study showed diffuse chronic interstitial fibrosis with hyaline degeneration in muscularis and submucosa, and increase of eosinophiles. It was thought to be of a benign nature, but was later determined to be malignant after extensive search of sections. The patient died six years later of heart disease without recurrence or evidence of metastasis, the general and local condition having been good on repeated examinations (personal communication).

25. *T. G. Miller* (52)

Male, age 31 years. X-ray examination showed barium immediately expelled, stom-

ach and duodenal outline not seen; with subsidence of ascites, palpable masses were found in abdomen. The man died two months later. Histologic study showed mucosa largely necrotic; submucosa very fibrous; muscular coats thickened with large amount of connective tissue, many groups of large, flat cells with prominent deep-staining nuclei and occasional mitotic figures; muscularis infiltrated with nests of foreign cells; diffuse scirrhus carcinoma of stomach with beginning mucoid degeneration and secondary involvement of peritoneum, lymph glands, intestinal tract, and diaphragm. The case is unusual in that a scirrhus type of cancer had spread to the peritoneum and intestines generally and because the secondary involvement was not nodular but rather a diffuse infiltration. Autopsy revealed peritoneum covered with fibrous exudate; gastric walls thickened.

26. *C. Moncany and L. Cornil* (53)

The patient, male, aged 45 years, had had syphilis for a long time with coexistent cancer of the right tonsil. He died from hemorrhage due to ulceration of a branch of the thyroid artery. Histologic examination showed the gastric tumor was an atypical epithelioma having the appearance of linitis plastica, with cellular nodules penetrating the muscularis. Autopsy revealed a gastric tumor of linitic type in addition to tonsillar cancer, which was an undifferentiated malpighian epithelioma.

27. *E. Moschowitz* (55)

Male, age 70 years. Histologic study disclosed scirrhus carcinoma involving the submucosa and extending into the muscularis. There were associated cardio-vascular changes as noted by Krompecher. The anatomic diagnosis on autopsy was linitis plastica.

28. *E. P. Palmer, W. W. Watkins, and H. P. Mills* (59)

Female, age 65 years. X-ray examination showed stomach narrowed, stiffened in pyloric portion. A rounded protuberance from the pyloric portion was not diagnosed but at operation proved to be gallstone. Diagnosed as cancer, advanced, probably operable. Partial gastrectomy and cholecystectomy were done. The tumor involved the pyloric and middle thirds of the stomach. Histologic study revealed linitis plastica, malignant. Although the patient enjoyed good health for three years, she eventually developed complete obstruction in the rectosigmoid junction with metastases to all glands and the liver. Colostomy was performed but the patient died in three months of carcinoma of the colon, thought to be independent of the linitis plastica (personal communication).

Palmer reports three additional cases: one recovered after partial gastrectomy; in the other two, the metastatic involvement precluded any hope of obtaining results by gastrectomy, and, therefore, gastro-enterostomies were done. The patients died a few months later (personal communication).

29. *V. Pauchet* (61)

The author reports a case of long-standing dyspepsia with frequent, scanty vomiting. X-ray examination showed a hardened, retracted stomach of reduced capacity. Gastrectomy was performed. There is no follow-up. Histologic study revealed cancerous degeneration in many areas.

30. *F. Plettner* (63)

Case 1. Female, 61. X-ray examination showed pylorus indistinct with tip drawn out, lesser curvature free. Pyloric tumor resected but the woman died suddenly of embolus. On histologic study, only almost by accident were cancer cells found in what appeared to be nonspecific granulation tissue;

one lymph node showed metastatic infiltration; four others were negative.

Case 2. Male, age 50 years. Apparently the X-ray examination indicated carcinoma, but clinically it was found to be hour-glass stomach (ulcer). An X-ray examination one year later showed meal collected in cardia, passing in a narrow column through the stomach. Jejunostomy was done but the man died one month later. No histologic examination was made. Autopsy revealed diffuse gastric carcinoma, marked contraction of stomach, extensive adhesions, metastases in regional lymph nodes and peritoneum.

Case 3. Male, age 64 years. Following eighteen months of gastric disturbances, the patient died suddenly from bilateral pulmonary embolism. Upon autopsy being carried out, diffuse contracting carcinoma of stomach with metastases to peritoneum were found.

Case 4. Female, age 52 years. Inoperable carcinoma of stomach was found on exploratory laparotomy. Autopsy showed diffuse contracting carcinoma of stomach with metastases to peritoneum.

Case 5. Female, age 59 years. There was improvement following posterior gastro-enterostomy two years previously, but the symptoms recurred. The woman died suddenly of aspiration bronchitis and pneumonia. Autopsy revealed diffuse contracting carcinoma of stomach with narrowing of pylorus and metastases to peritoneum.

The author considers these cases as belonging to the fibro-carcinoma group but, from the gross descriptions and in the absence of histologic examinations, it would appear that they are more properly to be classified with the strictly scirrhous carcinomas.

31. *M. F. Porter* (64)

Male, age 46 years. At operation for gastric carcinoma, the entire stomach was

found involved in a tumor without glandular extension. Subtotal gastrectomy and jejunal anastomosis with Murphy button were performed. The patient was free of symptoms for some time but the tumor again developed and he died in six months. Diminished stomach capacity and several mucosal ulcers were noted on gross examination. Histologic study disclosed carcinoma cells in wall adjacent to ulcer; clinically associated cardiovascular changes in accordance with Krompecher's theory of origin of the stomach changes.

32. *M. R. Reid* (65)

Female, age 51 years. Total gastrectomy was performed for almost complete pyloric obstruction due to fibrotic changes in the walls without extension. There was satisfactory convalescence with gain in weight. The woman carried on household duties for sixteen months, finally dying of intestinal obstruction (carcinoma). Histologic examination revealed diffuse sclerosing type of scirrhus carcinoma which involved all of the stomach walls except a small portion at the fundus; grossly typical of linitis plastica. From a study of the stomach sections, it was anticipated that recurrence might take place earlier than is usual in linitis (personal communication). Autopsy showed carcinoma in isolated patches in the transverse colon and jejunum, apparently without direct extension from primary stomach lesion but microscopically they were identified as recurrent lesions. No other metastases were found.

33. *Brahic J. Roussacroux and Villaret* (67)

Male, age 41 years. X-ray examination showed no peristalsis, stomach small and narrow. Diagnosed as plastic linitis. The patient died six weeks later. Histologic study disclosed glandular formation of mucosa completely changed with neoplastic cells in rows in place of tubular glands.

Autopsy revealed ascites, great omentum retracted and studded with hard granulations; stomach small, and walls rigid.

34. *J. Sailer* (69)

Male, age 46 years. First diagnosed as severe catarrhal gastritis which improved for a short time under strict diet. X-ray examination showed rapid emptying and thickened gastric walls. Exploratory laparotomy disclosed what was thought to be carcinoma, although no metastases were found. Six months later the patient showed marked deterioration with palpable epigastric masses. Jejunostomy was done, but the man died in three weeks. Histologic study disclosed primary mucoid or colloid carcinoma of greater curvature with low cellular vitality; mucoid degeneration and death of invading cells. Autopsy revealed diffuse thickening of stomach walls, patulous pylorus, thickening of omenta, atrophy of liver.

35. *G. D. Shaw and J. F. Venables* (71)

Case 1. Male, age 33 years. X-ray showed the stomach to be small, tubular; no peristalsis, rapid passage of meal through patent pylorus. Gastrectomy was impossible due to firm adhesion of the stomach to the surrounding organs. The patient died of exhaustion two weeks later. Autopsy disclosed typical leather bottle stomach with areas of superficial ulceration in mucosa; entire organ infiltrated with malignant growth, invading pancreas; metastases in glands at hilum of liver and in liver and spleen; mediastinal glands involved as also were the lungs by invasion along the bronchi.

Case 2. Female, age 52 years. X-ray examination showed high and tubular stomach, no peristalsis, rapid evacuation. Provisional diagnosis was linitis plastica. The woman died ten days later. No autopsy was held.

36. *A. L. Stavely* (76)

Male, aged 48 years. On the supposition of carcinoma of the pylorus, the abdomen was opened. The stomach was found to be much contracted and the walls thickened, with firm, hourglass contracture. Heineke operation was performed and, five weeks later, total gastrectomy. There were two conflicting reports histologically, reconciled by the fact that the second examination was made from a section taken from an area with sparse epithelial invasion. The diagnosis was carcinoma. Without having suffered recurrence, the patient died several years later of a cause not known. No autopsy was held (personal communication).

37. *M. H. Streicher* (79)

Female, age 52 years. X-ray examination showed marked retention of meal with pyloric obstruction. There were four plus Wasserman tests. Biopsy of inguinal gland was suggestive of chronic non-specific inflammation. No response was made to anti-syphilitic therapy. Posterior gastro-enterostomy revealed the stomach hard, thick-walled, and much thicker at pylorus. A hard, sausage-shaped mass occupied the pyloric portion. Enlarged lymph nodes about the stomach revealed on section did not suggest malignancy. The patient returned two months later with recurrence of symptoms and died in one month. Histologic study showed submucosa of stomach primarily of dense fibrillar tissue, very much thickened, similar changes showing in the rectum. A band formed from the large omentum, the lower end of which was attached to the uterus, explained the recurrence of symptoms of obstruction. Diagnosis: scirrhus carcinoma of the stomach with stenosis of the pylorus and rectum. Autopsy disclosed stomach markedly diminished in size, pylorus diffusely thickened with narrowed lumen, infiltration of peri-

rectal connective tissue and constriction of rectum.

38. *Toussant* (83)

Male, age not given. The symptoms were present for many years but became aggravated and required relief. Positive Wassermann. Marked ascites (8,600 c.c. removed at one puncture). X-ray examination showed small stomach with several irregularities of the wall and apparent cancerous nodule in cardia, walls fixed. The man died of cachexia in one month. Histologic study disclosed typical lesions of malignant linitis plastica. Autopsy revealed: stomach hard with large glands adherent to surrounding structures; annular constriction of transverse colon.

39. *A. Vecchi* (84)

Male, age 53 years. Clinically diagnosed as neoplasm and subtotal gastrectomy performed with excellent post-operative course. Later follow-up is not given. Histologic findings: linitis plastica, malignant. As does Baumgartner (13), the author calls attention to the fact that the cancerous nature of the cells may be more readily determined by resort to mucin staining, but in a subsequent report (85) he states that this recommendation is withdrawn because it proved negative in two later cases (not reported). He concludes that the hyperplastic connective tissue reaction, which constitutes the macroscopical picture of linitis plastica, is strictly connected in his cases with the presence and the development of the neoplasm, although no plausible explanation can be given for these findings, which are invariably noted.

40. *J. F. Venables* (71)

Female, age 60 years. Upon X-ray examination, the barium meal pursued a tortuous course through the stomach to the pylorus, rapidly emptying into the duo-

denum. No peristalsis was visible. Complete gastrectomy was done but the patient died twelve hours later. No histologic examination was made. Autopsy revealed the entire stomach infiltrated with growth, which ceased abruptly at the pylorus and cardia.

41. *G. Woolsey* (87)

In discussion of Johnson's case (38) Woolsey reported a case in which he performed a gastro-enterostomy, the patient apparently regaining his health, only to die two years later of carcinoma of the stomach, of a type not stated.

42. *S. Wyard* (88)

Seven cases; two of scirrhus carcinoma, two of the cylinder-cell type, and three of the colloid type. The article cites one example of each type. In the scirrhus type case, the histologic findings are typical of scirrhus carcinoma except that, instead of forming a mass, the growth spread in the submucous planes. The histologic features of the cylinder-cell type were its similarity to the scirrhus type but with the cellular elements predominating instead of the fibrous; also there was no evidence of submucous infiltration. The mucosa was much altered and converted into carcinoma. The colloid type showed a typical picture microscopically, the parenchymal cells being destroyed by colloid degeneration.

43. *D. Cesa-Bianchi* (20)

Female, age 35 years. In a patient suffering with digestive disturbances, numerous cutaneous nodules appeared generally, first in the epigastric region. Laparotomy disclosed negative findings. Upon histologic examination, the biopsy showed the nodules to be metastatic from a primary tumor of the digestive tract. The stomach specimen showed typical malignant linitis plastica.

Autopsy revealed a small stomach, with thick and rigid walls.

44. *P. M. Barlaro* (11)

Malignant linitis plastica occurred in a patient with pulmonary tuberculosis. The histologic examination showed cellular infiltration about the secretory tubes.

45. *A. Furno* (32)

Female, age 40 years. The case presented negative X-ray findings and a positive Wassermann, with death due to nephritis. Histologic findings were lesions of malignant linitis plastica, showing both inflammatory and neoplastic characteristics of the disease. Autopsy showed: small stomach with thickening of the right half of the pylorus.

SERIES B.—CASES REPORTED AS BENIGN OR AS DUE TO SYPHILIS

1. *A. F. R. Andresen* (4)

Female, age 38 years. Laparotomy disclosed a small stomach with greatly hypertrophied walls and the pylorus adherent to the gall bladder. The woman was discharged improved, but returned in a moribund condition two years later. Histologic study revealed the typical findings of benign linitis plastica. Autopsy disclosed: stomach buried in adhesions, very narrow passage through pars media; capacity of fundus 1.5 ounces.

2. *M. Agrifoglio* (7)

Case 1. Male, age 52 years. X-ray examination showed small stomach without peristalsis but with rapid emptying. Exploratory laparotomy revealed a small, retracted stomach with hard, uniformly thickened walls. Histologic findings were: tissue essentially composed of fibrous elements, benign.

Case 2. Male, age 47 years. X-ray examination showed: pervious pylorus, stomach normal in size, transverse colon apparently enveloped in a tumescence. Exploratory laparotomy disclosed thickening and retraction of lesser curvature from pylorus to median portion. Histologic study revealed: abundant connective tissue penetrating glands to point of atrophy, slight lymphocytic infiltration at base of mucosa; substitution of large cords of fibrous tissue forming a network in close meshes for normal tissue of submucosa, benign.

Case 3. Female, age 49 years. X-ray examination showed: ptosed stomach, normal peristalsis, followed by antiperistalsis, 6-hour retention. Assumed to be pyloric stenosis of benign nature. Pylorotomy was done. Histologic study disclosed notable thickening of gastric wall, due to enormous development of connective tissue which intertwined and penetrated the glands at the base, benign.

Case 4. Female, age 52 years. X-ray examination showed: dilated, ptosed stomach, hypertonic, slow emptying with partial 6-hour retention. Histologic findings were marked thickening of the submucosa though all tunics affected; benign.

3. *G. E. Armstrong and H. Oertel* (6).

Three cases, ages 55, 61, 63, two of them in women. Partial gastrectomy with posterior jejunostomy performed in all with uneventful convalescence. All were well at date of publication. These cases, with one other, which is not reported, are the only ones of record at the Royal Victoria Hospital (1914).

Pathologic Reports of Specimens Excised.—Case 1. Narrowing of pylorus, ring thickened. One area of duodenal involvement was noted, an unusual finding, as such a lesion was mentioned in only one other case in this review (Case 1, Faroy, 29). The walls of the stomach were thickened.

Careful search failed to reveal any evidence of carcinoma.

Case 2. Primary mucosal lesion with fibrosis and thickened submucosa, benign.

Case 3. Cellular infiltration, eosinophils, plasma and endothelial cells were noted in glandular regions but without evidence of carcinoma.

4. *R. M. Beath* (14)

Case 1. Female, age 30 years. X-ray examination showed: contracted stomach, rapid emptying. Death due to cachexia occurred four months later. No autopsy or histologic examination was made.

Case 2. Female, age not given. X-ray examination revealed a generally contracted stomach of tubular form, rapid emptying, no peristalsis. The subsequent history is not known.

Case 3. Male, age not given. X-ray examination disclosed: cardia dilated, tubular form, rapid emptying, dilatation of duodenum. The patient died twenty-six days later. No histologic examination or autopsy was made.

Case 4. Male, age 60 years. X-ray examination showed: stomach narrowed, tubular, irregular greater curvature, rigid walls, no peristalsis.

The author has diagnosed his cases on clinical evidence and roentgenologic findings. He comments on the histologic picture and states that the difficulty in deciding on the exact microscopic pathology is due to the fact that isolated glands are separated from their fellows by proliferated fibrous tissue, presenting the appearance of epithelial cell rests.

5. *K. Dwight* (25)

Two cases are presented. The first was probably an infiltrating type of newgrowth in which X-ray examination revealed an area in the antrum lacking in pliability, with small 6-hour residue. Partial gastrectomy

with posterior gastro-enterostomy was done. The patient was well on Nov. 16, 1930, seven years after the operation. The microscopic diagnosis was benign in all sections (personal communication). The second case showed an annular defect in the extreme pyloric end, characteristic of new-growth, not obstructive. Partial gastrectomy with posterior Polya was performed. There is a possibility of syphilis in this case as the patient had a four plus Wassermann but no evidence of syphilis was found in the sections which were considered benign. This patient was alive and well seven years later (personal communication).

6. *E. Enriquez and Gaston-Durand* (27)

Female, age 30 years. The patient had had tuberculosis five years previously. Diagnosis of linitis was made from gastric insufflation and X-ray findings. At operation there was liberation of gastro-vesicular adhesions. Mercurial treatment was instituted despite negative Wassermann tests, but with no result. The clinical picture remained unchanged for two years, and the patient was observed for nine years with regressive evolution of signs and symptoms.

Two hypotheses were offered for the regressive modifications of the stomach; either the linitis was an anatomic pathologic condition and not a disease, or syphilis or tuberculosis was responsible for the sclerotic condition of the submucosa. Had anti-syphilitic treatment been instituted earlier, before the affection had modified its aspect, a syphilitic etiology might rightly have been assigned to the condition. However, the clearly tuberculous history permits the interposition of an interstitial tuberculous infiltration of the stomach, slowly retroceding to the body of the stomach, to be maintained in the pyloric region.

7. *A. H. Harrigan* (34)

Male, age 51 years. X-ray examination

showed: stomach large, dilated, hypotonic, hyperperistaltic, with definite, persistent defect at pylorus, marked 6-hour retention. Diagnosed as chronic calloused ulcer at pylorus with early malignancy. Partial gastrectomy with posterior gastro-jejunostomy disclosed a large tumor at the pylorus with involvement of glands in the lesser omentum. Recovery was uneventful. Histologic findings were benign linitis plastica. The patient died nine years later from influenza or pneumonia (personal communication).

8. *E. O. Houde* (36)

Male, age 42 years. X-ray examination showed: constant defect in antrum, irregularity of greater curvature, peristalsis, entire stomach contracted, 2-hour emptying time. Clinically diagnosed as carcinoma on the base of an old ulcer of the antrum. At laparotomy the entire stomach was found involved with mass in the antrum. X-ray therapy was given for placebo effect. Clinical diagnosis post-operatively was linitis plastica. The patient died eighteen months later of exhaustion. Histologic study disclosed: typical linitis plastica diffusiva, fibrous infiltration without cell masses. Autopsy revealed no palpable involvement of liver.

9. *A. Landau, J. Cygielstreich, M. Fejgin, I. E. Grochowski, and E. Pietnik* (40)

Male, age 35 years. X-ray examination showed a funnel-shaped stomach. Diagnosis was linitis of syphilitic etiology. Wassermann positive. Vigorous anti-syphilitic treatment improved the patient but subsequent X-ray examination showed no change in the appearance of the stomach. The authors admit that the differential symptoms do not leave a wide berth to cancerous linitis and state that precious time may be lost waiting for the effect of specific therapy.

10. *L. T. LeWald* (42)

Case 1. Female, age 50 years. X-ray examination showed: deformity of horizontal portion of stomach, involving about one-third of the organ, resembling specific infiltration, rapid emptying (1-hour), slight dilatation of duodenum, some irregularity of cardia. Pre-operative clinical diagnosis was carcinoma of the stomach. The stomach was found infiltrated with a large tumor mass extending over the lesser curvature from cardia to pylorus. Histologic study revealed considerable increase in fibrous tissue of submucosa with no perivascular infiltration and diffuse overgrowth of fibrous tissue. There was no improvement under anti-syphilitic treatment and the woman returned eleven months later with aggravation of symptoms. X-ray examination confirmed the presence of leather bottle stomach. No further follow-up is given. The absence of cells suggestive of neoplasm in the specimen is emphasized.

Case 2. Female, age 23 years. X-ray examination showed: infiltration of pyloric half of stomach, patulous pylorus. Four plus Wassermann tests. X-ray diagnosis was syphilis with two subsequent confirmatory examinations. After two months of treatment, nausea and vomiting had ceased and five months later the patient was still further improved, but X-ray examination showed the pyloric deformity still present. Eleven months later, X-ray examination showed some absorption of stomach infiltration and the pyloric sphincter had regained its function. Nine months later there was normal parturition.

11. *A. F. Holding* (35)

Discussing LeWald's paper, Holding reported a case under observation for one year in which a suspicious filling defect, later not shown, was again demonstrated eight months later. It was thought to be carci-

noma, and pylorotomy was performed. The histologic examination showed benign linitis plastica. The patient remained in good health for three years, then had recurrence of symptoms with palpable abdominal tumor, dying seven years later of carcinoma of the colon, thought to be secondary to the primary stomach lesion. The diagnosis was clinical and roentgenologic only in the last instance (personal communication).

12. *A. Lloret Mingot* (43)

Male, age 40 years. X-ray examination revealed a cylinder-shaped stomach with smooth outline. Death resulted from inanition. Autopsy disclosed a typical case of gastric sclerosis (benign linitis plastica).

13. *Lossen and Kahl* (44)

(Also reported by Strauss, 78.)

Female, age 10 years. X-ray examination showed tubular narrowing of lower portion with retention in cardia, considered severe hour-glass stomach with circular tumor in descending part of stomach; linitis plastica considered. Operation revealed a severe hour-glass stomach, diffuse intumescence of lesser curvature. There was excision of part of the tumor and anterior gastro-enterostomy. The child doubled its weight in four weeks. Hereditary syphilis, considered a possible etiologic factor, was present. The microscopic sections revealed typical linitis plastica, benign, without the slightest evidence of syphilis. In the absence of all other etiologic factors, it is felt that syphilis must be considered as the probable factor, but the condition may not be pronounced so anatomically since there were no syphilitic transformations found on histologic examination.

14. *J. Martinez* (47)

Case 1. Male, age 42 years. X-ray examination showed: no peristalsis and rapid

emptying. Diagnosed as circumscribed linitis but operation was refused. Follow-up was not obtained.

Case 2. Male, age 46 years. X-ray examination disclosed: small, retracted, and immobile stomach, rapid emptying, no peristalsis. The man died in one month. No autopsy was held. The author has based his diagnosis on the clinical, physical, and roentgenologic findings. He also reports a malignant type case, Series A, No. 22.

15. *A. McGlannan* (50)

Female, age 22 years. X-ray examination showed: small, vertical stomach with pyloric stenosis, retention, and diminished peristalsis. The possibility of linitis considered on the findings. Posterior gastro-enterostomy showed the stomach small and adherent, walls rigid and thick. Recovery was uneventful. Three and one-half years later the patient had no symptoms present (personal communications).

16. *A. Mousseau* (56)

Male, age 52 years. Gastrostomy had been performed eighteen years earlier. The patient was now tired of this method of feeding and wanted the opening closed. Despite anti-syphilitic treatment, mucous patches formed. X-ray examination showed a stomach of normal capacity with soft walls. Gastro-enterostomy was done but the gastrostomy was not closed. The man began to eat normally, returning later for the closure. This case is one in which digestive disorders had evolved for two years, appearing six years after chancre, with a sudden gastric intolerance requiring gastrostomy. Nineteen years later, there was sufficient improvement to permit closure of the gastrostomy. The improvement was due to the use of mercury. At operation the stomach was small, infiltrated, grossly linitic.

17. *H. L. Northrop* (57)

Case 1. Male, age 60 years. X-ray examination showed diminished lumen. Tentative diagnosis was benign growth of stomach or gastro-colic omentum. Subtotal gastrectomy with posterior gastro-enterostomy showed the stomach involved in end-to-end typical linitic infiltration; pylorus thickened, no metastases. Histologic study revealed: hyperplastic fibrosis of submucosa, hyperplastic stroma of mucosa, with mucoid degeneration, endothelial cells and eosinophils especially evident; no evidence of malignancy. The patient remained well one year, then there was recurrence of the symptoms. Jejunostomy was done but the man did not like this method of feeding and attempted to eat by mouth; however, he vomited all food. He died within three months. The microscopic description in this case reveals features which other authors classify as malignant findings.

Case 2. Female, age 26 years. Posterior gastro-enterostomy was carried out on diagnosis of gastric cirrhosis, and the walls of stomach found to be thickened on the right side. Eight months later exploratory laparotomy showed extension of the thickening to the entire stomach. The patient died two months later. No histologic examination was done. Assumed benign by author.

18. *J. W. Ousley* (58)

Male, age 25 years. The patient had a history of chancre eight years previous to examination. Wassermann positive. X-ray examination showed the stomach narrow with gaping pylorus and peristalsis apparently absent, which was suggestive of gastric newgrowth or leather bottle stomach. Syphilitic etiology was assumed and treatment instituted, but no further follow-up was obtainable.

19. *H. A. Singer* (73, 74)

Case 1. Male, age 53 years. X-ray ex-

amination showed dilatation of lower end of esophagus, delay in passage of meal, narrow, tubular stomach. Assumed to be scirrhous carcinoma. Jejunostomy performed. Death resulted from general peritonitis. Histologic study disclosed: no distinct evidence of carcinoma in many sections from the stomach or perigastric lymph glands after careful search; atrophy of mucosa, dense fibrous thickening of submucosa, extension of connective tissue bands through muscularis, alteration of normal structures of lymph glands by fibrous replacement. Autopsy revealed: diffuse fibrinopurulent peritonitis, stomach extremely shrunken, lumen greatly diminished, walls thickened.

The case is interesting because of the clinical observations of Dr. Lawrence Jacques, who reasoned that, since the patient had vomited coagulated milk a short time previously and later failed to do so, there was an extension of the original process, and, accordingly, arrived at the diagnosis of leather bottle stomach prior to the X-ray examination.

Case 2. Gastric resection with recovery. The patient was alive and well Oct. 29, 1930 (personal communication).

Case 3. Died; specimen obtained at autopsy.

In these two cases, certain laboratory and clinical observations, such as positive Wassermann tests, the type of X-ray deformity, the long duration of the symptoms, and the achylia, spoke cogently for a syphilitic involvement of the stomach. In each case, the general characteristics of linitis plastica involving the distal portion of the stomach were present and the author feels that sufficient cumulative evidence is furnished to warrant the assumption of a syphilitic etiology.

20. S. Wyard (88).

(Also see Series A, No. 42.) *Local gastric fibromatosis:*

Case 1. Female, age 38 years. Partial gastrectomy for pyloric tumor and gastroduodenostomy done with recovery.

Case 2. Female, age 67 years. X-ray examination showed a filling defect of the pylorus with some degree of obstruction. Partial gastrectomy with gastrojejunostomy carried out. No follow-up is given.

Case 3. Male, age 37 years. X-ray examination showed definite, persistent pyloric obstruction. Exploratory laparotomy was performed but the patient died the ninth day.

In all specimens the histologic appearances were characteristic and bore no resemblance to malignant growth. In one specimen, local eosinophilia was noted as mentioned by Busacchi (18).

Case 4. Female, age 53 years. Laparotomy revealed typical leather bottle stomach but surgery was impossible due to adhesions, and the woman died one month later. Histologically there was no evidence remotely suggestive of malignancy. Autopsy revealed stomach contracted and small; tumor mass involved pylorus chiefly; capacity much decreased. This case is described under the name of diffuse gastric fibromatosis by the author while the three preceding cases were termed local gastric fibromatosis.

SERIES C.—CASES IN WHICH A DEFINITE HISTOLOGIC DIAGNOSIS IS NOT GIVEN

1. G. Cluzet and J. Cluzet (22)

Female, age 52 years. Clinically diagnosed as linitis with esophageal spasm. X-ray examination showed the characteristic findings of linitis. No follow-up is given.

2. A. B. Johnson (38)

Male, age 35 years. A patient with the usual digestive disturbances made an uneventful recovery, following posterior gastro-enterostomy.

3. *G. Peco* (62)

Male, age 39 years. Clinically diagnosed as linitis plastica and still under observation.

4. *F. Talia* (80)

Female, age 40 years. X-ray examination showed pyloric incontinence, no peristalsis, lumen narrowed. The clinical diagnosis was linitis plastica, which was confirmed by X-ray examination.

5. *L. Tomasi* (82)

Male, age 37 years. X-ray examination showed no peristalsis and the pylorus permeable. Plastic linitis was assumed and confirmed by laparotomy. The stomach appeared as a semi-rigid tumor with hypertrophy of all layers.

6. *G. Morone* (54)

Female, age 49 years. The diagnosis was palpable epigastric tumor. Laparotomy showed typical linitis plastica. No follow-up or histologic data are given.

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DISCUSSION

DR. RAYMOND G. TAYLOR (Los Angeles): While these cases are not very common, they are always interesting from a diagnostic standpoint. The general trend of opinion in the literature seems to be that they are cancers, as Dr. Brooksher suggests, and those in which the diagnosis of cancer is not made are quite likely to be those that have been very meagerly studied. As explained, the cancer cells may be almost entirely strangulated and obliterated by the fibrous tissue which forms.

DR. L. T. LEWALD (New York): Dr. Brooksher wrote me about cases which I have published. One was in a male 35 years of age, another in a male aged 71 years, and the third case—it turned out to be carcinomatous—was the earliest case of carcinoma of the stomach that I have seen, being in a girl 23 years of age. The next case, aged 53 years, was found

to be carcinomatous. The fifth case was distinctly a syphilitic stomach; this, I think, can be separated from the other groups.

As I have expressed my opinion in the matter, there are three groups, one of them syphilitic, one carcinomatous, and a third type that, on our microscopic examination at times, has showed only fibrous tissue. I know that some pathologists, and Dr. Brooksher, I believe, feel that they would have to include that type of fibromatosis as essentially malignant.

DR. BROOKSHER (closing): I have nothing to add except that I am familiar with Dr. LeWald's paper, published in 1921, in which he ascribes three origins to the condition: benign type, syphilitic type, and malignant type. I think that it would be well, for the purpose of etiology, to rule out those types considered syphilitic in origin.

I feel sure that all who have seen this condition know that grossly and roentgenologically it is a characteristic picture. The only thing we are faced with at this time is what to include under it. The majority think it is malignant. It has been shown that a benign type may occur, with all the characteristics of this lesion but without the so-called cancer cell. Dr. LeWald and others have also shown that there is a syphilitic lesion of the same type as the benign type. At this time it is a question of pathologic interpretation, but I hope that some day we can get down to a diagnosis and a proper pathologic interpretation. Meantime, from a pathologic standpoint, I think the term should be maintained to describe the condition which exists.

THE X-RAY TREATMENT OF HODGKIN'S DISEASE¹

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HODGKIN'S disease is used here to describe that particular clinical syndrome, febrile or afebrile in its acute or chronic but always fatal course, which has a rather definite peripheral blood picture and objectively has its beginning in one or more lymph nodes or some part of the auxiliary lymphoid system. It may remain localized or become generalized, presenting a characteristic histopathologic pattern consisting of proliferations of the reticular and endothelial cells, formation of lymphoid cells, characteristic giant cells, and a gradual increase of connective tissue resulting in fibrosis.

In 1832, Hodgkin (1) reported seven unusual cases of lymph node enlargement one or two of which (3), perhaps three (4), represented the peculiar and rare disease which in 1856 Wilks (2) described more accurately, and, in his second report in 1865, referred to as Hodgkin's disease.

A voluminous literature has grown up about its nature and etiology. It will not be possible here nor desirable to go into minutiae, but certain facts of the natural history of the disease should be appreciated before one may properly evaluate any claim to merit of any particular kind of therapy.

Whether it is a malignant tumor or an infectious granuloma remains unsettled. In 1863, Virchow considered it a "hard form" of lymphosarcoma. Kundrat, in 1893, segregated Hodgkin's disease from lymphosarcoma, which later he said originates from a single lymph gland or follicle, breaks through the capsule, and invades locally by way of the lymphatics with no diffuse or nodular metastases in the liver or spleen, or bone marrow changes (13).

Because Sternberg in 1898 was so certain that Hodgkin's disease represented an unusual type of tuberculosis of the lymphatic system, Dorothy Reed (3) made an intensive study of the autopsy material of this disease at Johns Hopkins Hospital. Her paper (1902), which has become classical because of its clean-cut description of the histopathology of the disease, concluded that tuberculosis had no direct relation to the subject. Longcope (4) confirmed her work. While rejecting the tubercle as the etiological agent, both agreed the disease was in the nature of an infectious granuloma.

Oliver (5), Mallory (6) (1914), Levin (7), and Warthin (8) (1923), among others, accept the neoplastic view of the origin of Hodgkin's disease. Mallory refers to it as the sclerosing form of lymphoblastoma, the distinguishing feature of which is the presence of tumor cells, often in very small numbers, which are different from any cells found in chronic inflammatory processes.

To Symmers (9) it seems that Hodgkin's disease does not provide any criteria by which it may be grouped either among the inflammatory diseases or among the neoplasms, but that for the purposes of classification it must be included elsewhere.

If anything is to be said in favor of one or the other view, it is that Hodgkin's disease more closely approaches an inflammatory disease in that it maintains its histologic individuality through all changes of environment. He offers the concept that Hodgkin's disease is an affection of the hemolytopoietic apparatus.

Fraenkel and Much in 1910 described certain granular rods found by them in cases of Hodgkin's disease which they be-

¹Read before the Radiological Society of North America at the Sixteenth Annual Meeting, at Los Angeles, California, Dec. 1-5, 1930.

lieve are tubercle bacilli. These rods are antiformin-fast and Gram-positive but not acid-fast. In explanation of this, Lichtenstein asserts that in the lymph glands tubercle bacilli are robbed of their acid-fastness by the action of the lipase of the lymphocytes and killed or restrained by the bactericidal action of the lymphoid cells.

According to Simonds (10), other investigators have considered these organisms identical with the diphtheroid bacilli first cultivated in Hodgkin's disease by De Nigri and Mieremet to which Bunting gave the name *Bacillus Hodgkini*. Cunningham (11) went so far as to say that these organisms represented contamination and their natural habitat was the laboratory.

The production of Hodgkin's disease in lower animals by inoculation of *Bacillus Hodgkini* and related diphtheroids, or with material from emulsified glands, has not given uniform results. Failure, however, to reproduce characteristic Hodgkin's disease in experimental animals need not prevent one from accepting the view of its tuberculous nature for, as Simonds notes, typical typhoid lesions have not been produced in laboratory animals by inoculation with *Bacillus Typhosis*.

Symmers has made the striking observation that the great share of the burden in Hodgkin's disease is borne by the lymph glands of the abdomen, thorax, neck, axillæ, and groin, together with the auxiliary lymphoid system, chiefly the liver, spleen, and thymus, while the faucial and lingual tonsils and that vast array of lymphoid follicles which lie in the submucosa of the gastro-intestinal and urinary tracts invariably escape. This, he says, seems to substantiate the view that the provocative agent does not enter through the skin but exclusively through the mucous membrane. It passes the first barrier (submucosal collections) to produce its greatest degree of reaction in those lymphoid structures which

are situated at strategic points for purposes of filtration (lymph nodes), and it may filter through the first and second to produce its changes in the spleen or thymus. This selective action, as Simonds terms it, also applies, he says, to tuberculosis of the lymphadenoid tissue, since tuberculous ulcers of the intestines rarely involve the Peyer's patches or the solitary follicles.

Healthy chickens inoculated by L'Esperance (12) with emulsions of lymph nodes developed either a typical or an atypical tuberculosis comparable to avian tuberculosis with the histologic features of Hodgkin's disease.

From more recent studies, L'Esperance believes the conclusion permissible that Hodgkin's disease may at least often represent an avian tuberculous infection.

At any rate, to use Ewing's phrase, tuberculosis follows Hodgkin's disease like a shadow.

The relationship of Hodgkin's disease to the other diseases of the lymph glands has been provocative of much writing. There is a tendency to combine lymphatic leukemia, lymphosarcoma, and Hodgkin's disease in one group, but as Webster (13) has said: "The ever increasing intermediate forms and transitional stages increase beyond reason the power of the personal equation," which is a euphemistic way of saying it gives one a headache. It would seem best to maintain distinction based on histopathology between the different forms of lymph gland enlargement until their origin is known.

Foremost among the high lights of the general picture of Hodgkin's disease, the significance of which we should properly interpret because of their diagnostic and therapeutic implications, are those of age and sex in relation to duration of the disease.

More than 50 per cent of Bunting's (14) cases occurred between the fifteenth and

thirtieth years. In one hundred and seventy-seven cases, Minot and Isaacs (15) found the incidence of this condition the greatest in persons of from 20 to 30 years. Youth is subject to the acute form with early death. They show that among the males the chances for a long duration of lymphoblastoma are definitely greater for those over 34 and under 65 years of age than for those below 25; that most of the cases of short duration occur in males and women live longer than men after lymphoblastoma develops. In Minot and Isaacs' group of 401 cases of lymphoblastoma, the average duration was 2.76 years; one of their cases lived $17\frac{3}{4}$ years. Lerche has reported a case of a woman living after 18 years and Cunningham has reported one who lived 25 years. As Minot and Isaacs have stated, the type of case that naturally lasts long is the one with the slow rate of progress early, spontaneous remissions, and apparently with the initial lesions developing in parts of the body readily accessible for therapy.

While we most often think of Hodgkin's disease as one involving the lymph nodes, spleen, and liver, it should not be forgotten that the primary focus, at least at the time of discovery, may be elsewhere. Reeves (16) found seven cases which began in the tissues of the orbit. The first case, aged 28, treated by radon, returned two months afterwards with a picture of generalized Hodgkin's disease. Blount (17) reported a case in which involvement of the spine and left shoulder preceded generalized enlargement of the lymph node. The original diagnosis was Pott's disease. The original roentgenogram showed wedge-shaped bodies of the seventh and eighth dorsal vertebrae with preservation, however, of the intervertebral discs. In passing I might say this should make a roentgenologist wary of such a diagnosis. X-ray examination showed also destruction of the head and upper shaft of the

humerus. Pain with limitation of extension developed later at the left hip. The X-ray examination was negative. Under deep X-ray therapy this disability cleared up, and to the surprise of everyone the symptoms at the left shoulder cleared up—another instance of so-called distance effect which is often questioned. Lockwood, Johnson, and Narr (18) report a case of a boy of 15 whose spine showed involvement of the first lumbar vertebra with rarefaction of the pelvic bones and the head and neck of femur. Hultén (19) describes a case of lymphogranuloma with extensive skeletal changes, among them being complete sclerosis of the second lumbar vertebra, and he draws attention to the advisability of examining the skeleton more often in this disease. Symmers believes that it is involved in all cases. I have only to refer you to the work of Holmes (20) on lymphomatous lesions of the gastro-intestinal tract and that of Dreser (21) on osseous lesions to call to your attention how important a factor roentgen rays may be in diagnosis.

Anemia, usually of the secondary type, is a regular accompaniment of this disease. In the early stage, Bunting says that the blood picture is not pathognomonic. The total leukocyte count is usually within normal limits or slightly above. After a slight early lymphocytosis, there is a constant decline in the lymphocyte percentage until in a well established case these cells represent but about 15 per cent of the count. There is also a gradually developing eosinophilia which is usually moderate but may become extreme. As the disease progresses there is a gradual change in the blood picture and the one which is pathognomonic in the absence of suppuration in the body. There is an increase in total leukocytes, usually to about 20,000, although they are not infrequently much higher; the lymphocyte percentage is often less than 5; the polymorphonuclear count is usually above 80 per cent and may

exceed 90 per cent; large forms of transitionals exceed the lymphocytes in number and usually maintain the high percentage of the earlier cases. This blood picture, however, may appear almost at the onset in Hodgkin's disease.

The therapeutics of this disease for the most part has consisted of arsenic, surgery, or irradiation, often a combination of all with the occasional isolated use of heliotherapy. Symmers says surgical intervention is hopeless and should never be undertaken except for the mechanical relief of conditions which threaten life or are intolerable, while Bunting states rational but radical surgical treatment early appears to offer the only hope of cure. Surgery, say Minot and Isaacs, probably can influence beneficially the duration of some cases of lymphoblastoma, particularly if it is employed early and thoroughly and is followed by irradiation.

Most agree with Elkin (22) that irradiation seems by far the better method of treating these conditions which in the past have been subjected to operation. Irradiation offers in the majority of cases definite palliation and not only retardation of the growth but an improvement in general health.

There is considerable evidence at hand, say Minot and Isaacs, that it is exceedingly easy for irradiation to cause a rapid dissemination of Hodgkin's disease, which composes the majority of the cases of lymphoblastoma in youth.

They further object that irradiation in what is often considered suitable therapeutic dose can lead to injury of lymphoid tissue and there occurs in Hodgkin's disease progressive sclerosis of this tissue which is reflected in the peripheral blood by the characteristic lymphopenia. That such treatment in undesirable amounts may intensify the process so that an increased rate of progress of the disease ensues although a

decrease occurs in the size of the irradiated lesion. They say such overdoses may well account for the high incidence of irradiated cases of short duration in youth.

I have been unable to find any documented evidence that it is exceedingly easy for irradiation to cause a rapid dissemination of Hodgkin's disease. In children it should be remembered that tuberculosis and Hodgkin's disease are apt to be associated. Such children, according to F. Parkes Weber (23) and others, often ultimately develop fatal disseminated miliary tuberculosis irrespective of the type of treatment.

Sclerosis of lymphoid tissue in Hodgkin's disease, as reflected in the peripheral blood by the characteristic lymphopenia, is a part of the natural history of the disease whether the case is irradiated or not. Indeed Symmers believes that the progressive overgrowth of connective tissue is Nature's method of healing. Treatment in undesirable amounts may intensify any process but there is no need for the administration of irradiation in undesirable amounts if the proper clinical story, peripheral blood picture, and pathology are conveyed to the roentgen therapist. I can not begin to tell you how difficult it is for me to obtain these data from the medical internist who looks aghast when I ask for them and resents my refusal to take his irradiation prescription, such as, "Fifteen minutes high voltage over lump in neck and lump in axilla."

Our problem has been complicated by the development in the last decade and a half of transformers and tubes to take care of larger energies all the while so that we have run the gamut of low, medium, and high voltage X-radiation with consequent changes in therapy technic. Minot and Isaacs say their studies suggest that, in spite of the progressive improvement in irradiation methods, patients with lymphoblastoma recently have not had the disease run a longer course than it did fifteen years ago. However, they say

the data concerning their 76 living patients, who, as a group, have had probably the best irradiation therapy, may be taken to indicate this is not necessarily true, and the chance for a long duration of their disease is more favorable than it was for the deceased.

Lerche (24) reports an extraordinary case of a patient who, although suffering with Hodgkin's disease, lived for 18 years. The patient had four operations on the cervical and paratracheal nodes followed by mediastinotomy. Lerche believed the X-ray treatments given in 1921 and 1922 were of greater benefit than those given in 1914. Yates, in discussing this case, said he believed that the patient recovered in spite of the radiation and not because of it, which is no more ungracious than to say the patient recovered in spite of operation and not because of it. On the other hand, most of us would feel that we had approached a cure if, with surgery and irradiation, our patients suffering from Hodgkin's disease would survive 18 years. If we are to put this patient's recovery in the category of the miraculous as Yates has done and say it is an example of unusual defensive powers developed under stress, then we are exactly where we started as far as therapeutics goes.

Let us proceed to a consideration of the results reported by roentgen therapists. Based on the records of 164 patients sufficiently complete to furnish statistics, Stone (25), using low voltage, says they indicate that only palliation can be expected. Prompt and apparently complete regression of enlarged nodes led him, in the hope of producing a cure, to give prophylactic treatments over areas where tumors might be expected to appear. Recurrent tumors, however, developed and new tumors appeared in the field which had been treated prophylactically. Applications to these areas, however, were found to be less effective than applications to areas

which had not been previously treated. He states there seems to be no advantage in the use of high voltage machines.

At the outset, the quality of radiation employed should be of only moderate penetration, says Desjardins (26). If the radiologist "shoots his heaviest bolt" first in the form of high voltage roentgen rays, gratifying and startling immediate regression may result, but later, when recurrence of adenopathy causes the patient to seek further treatment, such treatment will be found much less effective. Therefore, inasmuch as radiotherapy has been shown not to prevent the fatal outcome of the disease, no matter how treated, it is evidence of good judgment to reserve the heavy artillery until the lighter guns have exhausted their effect.

The treatment should be rather general and should be directed not only to the palpably enlarged nodes or masses of nodes, but also to the mediastinal and lower paravertebral lymphatic chains, even though definite evidence of disease in these regions should be absent. He cites four cases treated in various stages of disease but gives us no data upon which conclusions can be drawn as to duration.

Chamberlain (27) reports twelve patients with Hodgkin's disease treated with small doses, two of whom have died. Of the ten patients still living, seven have been under treatment for less than a year.

His routine procedure consisted in administering a 5 per cent erythema skin dose to very wide areas over the entire trunk, accomplished by exposing six 25 cm. diameter areas, three in front and three in back, at intervals varied from one to four weeks.

Chamberlain speaks of a 5 per cent erythema dose at the skin and thinks it a more significant way than by the usual factors of tube current, crest voltage, anode skin distance, and time. Of course, he is fully aware that all these bear a direct relationship to skin erythema but his terminology

has merit because it accentuates the physical fact that small doses can be administered with high voltages and the biologic fact that absorbed radiation rather than quality is the thing to be considered foremost, the advantage of high voltage being that more irradiation can be given at a depth without skin damage.

Evans and Leucutia (28) believe the treatment of Hodgkin's disease should be as extensive as possible. They believe that intensive radiation, hard rays, should be used, and that, without treating the distant extensions of the disease, local treatment of the manifest tumor masses is of little avail. In their cases of Hodgkin's disease, they use a 90 per cent S.U.D. over large areas and a 100 per cent S.U.D. over small areas with a roentgen ray of 0.13 to 0.14 Ångström wave length, the same delivered within a week to each of the superficial lymph node areas, the mediastinum front and back, the abdomen posteriorly and anteriorly, and the right and left oblique fields. A severe reaction follows which lasts for several months.

When the lesion is localized and the general condition of the patient is good, they use intensive radiation as outlined above, but when the lesion is already generalized, and especially when there is a severe anemia, small fractional doses are employed.

Because of the tendency of the tumor to remain localized for a longer period, they believe the treatment of mediastinal Hodgkin's disease is much better than that of an average case of Hodgkin's granuloma.

The same criticism applies here as to so many reports by roentgen therapists, namely, that cases have not been followed long enough to know whether or not as a group they behave any differently than a control group not irradiated or irradiated in some other manner.

For ten years (1915-1925), Voorhoeve

(29) of Amsterdam has employed 160-200 K.V., with 0.5 mm. Zn and 1 Al, giving each portal a 90 per cent S.U.D. over a period of from 2 to 4 weeks in daily fractions depending on the size of the portal and the focal skin distance. He estimates an absorption of 70 per cent S.U.D., followed by a second series in three months. He reports eleven cases treated in what he describes as a rational manner, seven of which are dead and four living. The average duration of life for the former from the beginning of symptoms was 3.8 years; for the latter, 4.4 years; for the whole group, 4 years, with an estimated prolongation of life by therapy of 2.3 years. The ages were 8 to 49; six were females and five males. Four of these cases were desperate and in form very grave.

He is opposed to the so-called prophylactic irradiation of normal tissue and confines his X-radiation to evident pathologic localizations.

More recently Gilbert (30), of Geneva, has reviewed with his assistant, Babaianz (31), twenty-five cases of Hodgkin's disease, fourteen of which were treated with high voltage radiation in the period from November, 1922, to December, 1928. At Gilbert's clinic, 180-200 K.V., 0.5 mm. Zn, 1 Al, filtration is used. Superficial and deep lesions are treated with the same quality of ray, varying the focal distance and size of the portal of entry. As a rule the average total dose is 1,000 to 1,200 R Solomon, given fractionally so that each portal will receive the total dose in from 10 to 15 days. The duration of all treatments is not to exceed 4-5 weeks given in daily sessions and every other day or twice daily with several applications to each portal. If there is no result from the first series, it is repeated after from 6 to 8 weeks. He irradiates widely from the start, not only palpable and visible localizations, but those areas most likely to be the seat of extension.

Of their group of fourteen, seven are living and seven are dead. The average duration of life for the former from the beginning was $34\frac{1}{2}$ months; for the latter 96 months; for the whole group, $65\frac{1}{4}$ months.

On the face of it, their cases seem to have done better than those of Voorhoeve by more than a year. An analysis of the age and sex incidence shows, however, that of these fourteen cases eight are females and six males. The males were aged 30, 33, 37, two were 39, and one 44, all destined to have the disease a long time. Of the females, one was 16, 19, 22, 27, two were 28, one 33, and one 37, all destined by nature to have the disease a long time.

I have examined the records of nineteen cases of Hodgkin's disease treated in the X-ray Department of the Boston City Hospital over the ten-year period 1919-1928, fifteen of which were males and four females. Of the males, seven were in the 20-30 age group, and four were in the 30-40 age group. All of the series are dead. The average duration of life for the group from the beginning of symptoms was 3 years, 11 months, which is comparable with Voorhoeve's and Gilbert's series when age and sex incidence are evaluated.

All of the group treated at the Boston City Hospital (with the exception of four that had low voltage) have had medium voltage (145 K.V.) therapy with 0.25 mm. Cu and 1 Al filter, in fractional doses directed only to the palpable or objective sites of the disease.

Of late, at the hospital clinic we have employed 185-200 K.V. with 1 mm. Cu and 1 mm. Al filtration in fractional doses, being guided as to dosage by the response of the localized lymphomatous masses, the systemic reaction of the patient, and his blood. We do not find it necessary to approach the erythema dose but know always that that reserve is at hand. And as I see it, that is the value of high voltage—one may use ef-

fective fractional doses of such irradiation over long periods of time without skin damage.

So-called prophylactic radiation has not been employed because in this disease one usually is treating a patient already prostrated. With the information at hand, no ultimate benefit is seen from general body radiation, while it has been shown by Russ and others that grave damage to normal tissue may result, damage which is not easily made good.

I have not been able here to go into how X-rays act, whether directly or indirectly on the blood, perhaps liberating a leukotoxin, or on the leukopoietic centers, thus averting the production of new white cells. This has been dealt with at length in the excellent monograph of Babaianz.

If the provocative agent in this disease is finally shown to be the tubercle, it would then seem necessary to employ heliotherapy much more generally than is now the practice. Some cases of the Pel-Ebstein type that have come to my attention have done well with sunlight. Irradiation of much shorter wave lengths, however, appears necessary for the average run of cases.

The statistics of Voorhoeve, Gilbert, and my own clinic, I believe, show progress. As Jackson has said, it seems futile to argue against the prolongation of life by irradiation when all of us have treated cases in extremis from mediastinal Hodgkin's disease and seen them restored to relative good health for long periods of time.

In résumé, certain statistics of roentgen therapists analyzed in the light of the natural history of Hodgkin's disease show that suitably filtered radiation over a rather wide range of wave lengths given in fractional dosage seems definitely to prolong life in selected cases and to the majority offers palliation with return to relative well-being not given as consistently by any other known therapeutic measure.

What has impressed me in reading the literature is how very little is known about a disease described so long ago, how difficult it is to appraise values, when one reflects that our knowledge of its histopathology is current with our present century, our knowledge of the blood picture coincident with the World War, its therapy a contemporary problem.

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DISCUSSION

DR. R. G. GILES (Temple, Texas): There is practically nothing one could add to Dr.

O'Brien's excellent and interesting paper. He is to be commended for the energy and time he has spent in collecting from the literature much of the material for this paper. He brings us a résumé of Hodgkin's disease since the first cases were so termed by Thomas Hodgkin, nearly one hundred years ago. Perhaps further emphasis upon a few of the salient points will not be out of place.

The original group of diseases, as first described by Hodgkin in 1832, has been separated into leukemia, pseudoleukemia, lymphosarcoma, and Hodgkin's disease. The present classification is based upon difference in histologic structures, and must form the only basis for diagnosis until the etiology has been established.

At the present time, lymphosarcoma and Hodgkin's lymphogranuloma are very closely associated from the standpoints of history, clinical course, and, at times, even microscopic study. The leukemias can usually be ruled out by the blood picture. Hodgkin's disease and lymphosarcoma may have their origin in any part of the body where lymphoid tissue exists. In making a hasty and casual review of the recent literature we were especially interested to note that cases have been reported in which the primary or predominant clinical localization appeared in the skin, lacrimal and salivary glands, tonsils, trachea and bronchi, nose, esophagus, stomach, intestine, spleen, liver, pancreas, abdominal lymph nodes, thymus, mediastinum, heart, hematopoietic, nervous, and osseous systems. Nevertheless, there can be little doubt that, in a large proportion of cases, the glands first demonstrated are the superficial lymph nodes on one side of the neck. Soon other glands, which make their appearance on the same side as well as the opposite side of the neck, become progressively larger.

A. E. Moon has analyzed the records of 47 patients with lymphosarcoma and Hodgkin's disease, studied at the Scott and White Clinic during the past nine years. Of this number, 27 were males and 20 females. The youngest was six years and the oldest 77 years of age.

	Cases
Under 10 years of age.....	2
10-20	6
20-30	11
30-40	9
40-50	7
50-60	6
60-70	5
Over 70	1

The primary localization of these 47 cases was as follows:

Neck	30
Mediastinum	6
Abdomen	5
Retroperitoneal region	0
Axillary region	1
Sternum	1
Breast	1
Inguinal region	1
Nose and antrum.....	1
Left arm and axillæ.....	1

As roentgenologists, we should be interested in Hodgkin's disease because radiation therapy is to-day perhaps the only rational treatment for the disease. The majority of the patients are treated for cervical, supraclavicular, axillary, and inguinal glandular enlargement with or without splenic enlargement. Neither medical nor surgical measures has been of much avail in the treatment of this disease. Surgical measures to-day are limited to the removal of a lymph node for microscopic study in order to establish the diagnosis.

The response to X-ray treatment is at times remarkable, large glands melting away with one or two treatments. Response to treatment is markedly variable, some clinically severe cases responding rapidly to radiation. In other cases, the disease may be checked for a short time and then proceed to a fatal termination, while a few progress to a rapid termination in spite of all treatment. Palliation, according to Stone, will occur in about 60 per cent of the cases, Desjardins 80 per cent, and full restoration of health with or without regression of the tumors may occur in about 32 per cent. Prognosis is a relative proposition, depending upon the extent and primary loca-

tion of the lesion, and grade of malignancy as observed by the microscope. In our experience, the lesions confined to the neck, particularly one side, are most amenable to treatment. I would appreciate it if Dr. O'Brien would state whether Hodgkin's disease in his experience occurs more frequently on one side of the neck. The most hopeless are those involving the mediastinum, abdomen, and retroperitoneum.

Radiation therapy is the chief measure in the treatment of Hodgkin's disease and, even though no permanent cures can be promised, radiation makes these patients much more comfortable, and seems to increase their expectancy of life.

DR. FRANCIS CARTER WOOD (New York): May I add that Dr. O'Brien's admirable paper surveys the whole field.

The difficulty in deciding what is going to happen to the patient is based upon a number of things. Almost invariably those patients with a temperature do very badly. Also there is a type which cannot, in the early stages, be distinguished from lymphosarcoma. At a later stage, they may show a different type of lesion, with more fibrosis and characteristic cells and occasionally a case is seen which, when it comes for treatment, already has extensive fibrotic changes in the nodes. In the latter type, while but little obvious change in the nodes follows radiation, palliation is likely to be prolonged. But no one can tell, at the start, what is going to happen to the patient. As Dr. O'Brien has said, we have to treat these people as human beings who are sick.

Radiation should be light. Heavy radiation with high voltages, it seems to me, is not generally indicated. Standing ten or twelve feet from a patient who is getting high voltage radiation with high filtration, the bones of the hand can easily be seen with a fluorescent screen. That means an enormous amount of scatter from the primary beam. This scattered radiation strikes the bones, destroys the blood-forming organs, and hastens the patient's end rather than improves such a case.

With lower voltages, such scatter is not so marked and fairly heavy doses can be given.

Sometimes there is no prolongation of life: sometimes the lesions disappear for three or four years. However, these latter patients are not in perfect health, because recurrence takes place, chiefly in the abdominal nodes.

The difficulty is that we are dealing with three types of disease in Hodgkin's, just as we deal with a great variety of types in leukemia. In some patients, radiation is absolutely valueless. Of course everyone knows that radiation in acute leukemia is contra-indicated.

DR. A. C. SIEFERT (Oakland, California): I would like to emphasize that we must individualize. I treat these cases with 135 K.V. and 5 mm. of aluminum filter at 15 inch distance from the skin. I rarely go above 150 r units, and sometimes it is necessary to go considerably below that dose. Some patients will respond with much less, sometimes with a dose of, say, 25 r units. Therefore, it is necessary to individualize.

I have found, too, that the white blood count is of value. When the white blood count falls to 5,000 or below, it is best to stop and give the patient a rest, no matter whether or not there are large glands still present. In one case, I have seen lesions in the bones in a lumbar vertebra which yielded to X-ray. At that time I was ignorant of the fact that Hodgkin's ever did affect the bones, but I have since found out that it is not an uncommon occurrence.

DR. J. A. H. WEBB (Wichita, Kansas): I want to report a rather unusual case of Hodgkin's, at least the results have been different from any of those that I have had. The patient was a young man of about 17 years of age who was referred to me for treatment by a very competent internist and pathologist. He was under treatment for perhaps six or eight months. I lost sight of him, but was able to trace him later. All evidence of the disease had apparently disappeared. The young man joined the Navy and I had a report from

him only a few months ago that he had passed into the Aviation Department of the Navy without any evidence of disease and is still alive. This was four years ago. I wonder what he had.

DR. O'BRIEN (closing): In reply to Dr. Giles: When Reed finished her work, she thought one could not have Hodgkin's disease unless the glands of the neck were involved, but Symmers later showed from a review of

vast autopsy material at Bellevue that the cervical glands may not be involved at all, at least predominantly. My own impression is that, when they are involved, one usually sees them on the left side first.

I was glad to hear Dr. Wood speak about remission, which is something we must consider before we report cures, because some of these cases will have remissions over a long period of time, irrespective of the kind of therapeutics.

WARNS AGAINST RADIO-ACTIVE WATERS AND RADIUM EMANATORS

Warning against the use of radio-active waters and radium emanators, frequently promoted for the cure of a great variety of diseases and ails, was contained in a report by Dr. Harrison S. Martland, medical examiner, Newark, N. J., to the "American Journal of Cancer," made public here to-day.

From long study of the effects of radium poisoning in luminous watch dial painters, Dr. Martland has concluded that it is dangerous to increase the normal radio-activity of the human body, on the strong presumption that increased amounts of radio-activity over a number of years may produce cancer.

"The drinking over long periods of time of radio-active waters containing radon may allow a small amount of active, long-lived deposit to enter the body, part of which may finally be deposited in the bones and other organs as more or less insoluble salts," he stated.

Such deposits of insoluble salts of radium

and other radio-active substances were responsible for the development of fatal cancer (sarcoma) in watch dial painters, Dr. Martland showed in the report.

Some of the radio-active waters for sale, when taken according to directions of the promoters, would introduce into the body each day an amount of radio-active substance equal to that taken by some of the dial painters, he found. These substances are in soluble form in the water, but they are changed in the blood to the more insoluble carbonates, phosphates, and even sulphates of radium and mesothorium and eventually reach the bones. Once deposited there in insoluble form, there is no way known now to eliminate them from the body or to protect it from their fatal bombardment of alpha particles, with the exception, possibly, of methods of treatment similar to those used in the treatment of chronic lead poisoning.

Radium emanators, and the waters of natural radio-active springs, were objected to by Dr. Martland on the same grounds.—*Science Service*.

SPONTANEOUS ELIMINATION OF INTESTINE WITH TEMPORARY RECOVERY

REPORT OF A CASE

By DANIEL N. SILVERMAN, M.D., NEW ORLEANS, LA.

ATTENTION has recently been called to the very rare occurrence of spontaneous elimination of the intestine, especially since the advent of surgery. This fact, coupled with a unique condition where expulsion of two distinct segments of bowel has happened at separate intervals, accounts for a detailed report of the present case.

Spontaneous elimination of an intestinal segment is the most infrequent termination of intussusception. Intussusception of one type or another occurs frequently, as shown by the reports of numerous cases from year to year. Usually these cases, when not operated, develop complete intestinal obstruction and sloughing of the part with resulting peritonitis unless the patient dies meanwhile from toxemia and exhaustion. Should the usual auto-anastomosis of the two parts of the intestine develop, the intervening section may be eliminated.

From the statistics of Lichtenstern (1), one would judge that, before the advent of surgery, the termination of intussusception with spontaneous elimination and recovery must have been a comparatively frequent development. Forty-two per cent of this author's series of 593 cases underwent such development. Since his publication in 1877, few cases terminating in such a manner have been reported. Furthermore, the literature since the time of Lichtenstern is practically devoid of descriptions of cases in which multiple sphaceli were eliminated.

From the observation of Lichtenstern, it was learned that in adults the more common invaginations took place in the ileum and ileocecal valve. Ileal intussusception is found most frequently in the lower part and rarely in the middle portion. Colon invagi-

nations are more frequent in the descending colon and sigmoid flexure than in any other portion.

The separation of the intussusception occurs in the majority of cases from the eleventh to the twelfth day after the obstruction but in chronic cases it may not happen until after several months.

In 1894, each of two British writers (O'Conner, 2, and Sutcliffe, 3) independently reported a case of small intestine invagination and elimination. O'Conner's measured 11½ inches in length, 8 days after onset of severe pain. Sutcliffe's patient expelled 13 inches of what he thought was small intestine, though the physical signs pointed to obstruction beyond the transverse colon.

In 1906, Sherren (4) reported a case of spontaneous elimination occurring in a woman following an operation for the reduction of a hernia. The same case was later included in a series of cases of intussusception reported by Walton in 1911, it being the only one in his series of 239 cases.

In 1908 Fitzwilliams (5) reported a collected series of 1,000 cases of intussusception. He does not mention a single case undergoing spontaneous elimination, neither does he make any definite statement regarding the occurrence of such cases.

In 1927, Perrin and Lindsay (6) reported a series of cases of intussusception occurring over the period from 1903 to 1921. They reported 400 cases, but made the statement that spontaneous elimination did not occur in a single case.

In 1922, Martin reported a post-operative intussusception of the small intestine with elimination of intestine 27 inches long.

Microscopic examination of the specimen showed all three layers of the small intestine definitely enough to be recognized. The mucosa was necrotic.

In 1927, Thompson (7) reported spontaneous elimination in a tapeworm-infected child of four years. The intestinal segment was 14 inches long by $\frac{1}{4}$ inch in width.

Thompson stated that the report of his case emphasized the fact that acute intussusception may simulate bacillary dysentery in children, especially if it occurs during an epidemic of dysentery. His case also demonstrates the coincidence of intussusception with the presence of intestinal parasites, and is of further interest in that it terminated with auto-anastomosis and spontaneous elimination, which are rarely seen in this generation.

REPORT OF CASE

The patient was a white woman, 56 years of age. She was seen for the first time on May 13, 1929.

Present Illness.—Three weeks before this visit she had had two sudden chills followed by a temperature of 103 degrees. The fever was remittent in type, continuing for 10 or 12 days. It was accompanied by burning, nausea, and the vomiting of bile and any food eaten.

During the past year she had had some pain in the lower right side of her back, extending up to the small of the back on the same side and radiating along the iliac crest, anteriorly and forward to the right hip or lower abdomen. This was accompanied by frequency of urination. Alkalies relieved the pain and frequency. The patient had been constipated for many years. The constipation and abdominal pain were aggravated by roughage. Similar attacks of chills and fever had occurred in the past three years. Fatigue seemed to predispose to the trouble.

Past History.—The patient had been very "nervous" all of her life. In childhood she had had pneumonia and "lung fever." She had had rheumatism since 1893, when she was twenty. In 1909 she had influenza, followed by a nervous breakdown from which she recovered in three months. In 1926 she had hemorrhoids.

Menstrual History.—Menopause in 1921. No vaginal bleeding.

Family History.—Mother died of pneumonia when patient was 10 years old. Father died in Southern California of typhoid fever at the age of 64 years.

Physical Examination.—The patient was well developed and nourished. Temperature, 99.8. Pulse, 102-110. Weight, 132 pounds. *Head:* Pupils active, exophthalmic. *Mouth:* Mucous membrane pale, tongue coated, teeth good, tonsils irregular. *Neck:* Thyroid, particularly right lobe, enlarged. *Lungs:* Normal. *Heart:* Aortic dullness increased, slight left lateral enlargement markedly accentuated, no murmurs. *Abdomen:* Tenderness over area corresponding to the descending and ascending colon. Kidney, spleen, and liver not palpable. *Extremities:* Knee jerks very active. *Proctoscopic examination:* Digital, fairly large external hemorrhoids. Sigmoid, no ulcers, mucus present, prominent veins.

Laboratory Examination: Urinalysis showed the urine to contain a small amount of indican and an occasional pus cell. On one examination an occasional red blood cell showed.

The feces were solid, dark in color, and highly alkaline. Occult blood, fat, and starch were present. No ova or parasites were found.

The fractional analysis of the gastric contents gave a Ph of 3.0 for the first specimen and Ph 2.0 for the succeeding three.

The fasting gastric and duodenal contents in the duodeno-biliary analysis were nega-

tive. The bile was yellow brown and microscopically negative.

The blood picture was essentially normal, revealing only a moderate secondary anemia with a total red blood count of 3,900,000 and a total white count of 4,500.

Radiographic study of the kidney, ureters, and bladder showed no abnormalities, but the roentgenologist reported probable intrinsic disease of the gall bladder due to its very slight visibility following the oral administration of "Keraphen."

The patient was given sodium salicylate and bicarbonate and later Vichy tablets. She was seen from time to time during the next months and seemed much improved.

In 1925 or 1926 she had first noticed a protruding bladder. This caused increasing discomfort and grew larger during 1929. Before going into the hospital for a plastic operation to correct this annoyance, she presented herself on January 1, 1930, for a general physical examination. At this time she weighed 132 lbs. and had a blood pressure of 140/80. The first heart sound at this time was rough, otherwise the examination, including the urinalysis, revealed nothing abnormal.

Hospitalization.—She entered the hospital at 7:15 P.M. on Jan. 5, 1930, with a temperature of 98.6 degrees, pulse 90, and respiration 20. A soap-suds enema was followed by violent cramps which lasted until relieved by 2 gr. of luminal sodium, by mouth, and the insertion of a rectal tube at 1:00 A. M. After this the patient slept, but awoke the next morning complaining of rectal discomfort and inability to urinate. There was a bloody discharge from the rectum. Her temperature was 101 degrees, pulse 90 per minute, respiration 20 per minute.

Before being taken to the operating room the patient was given by needles 1/6 gr. morphin sulphate and 1/120 gr. atropin sulphate. She was operated on for a recto-

cele, a cystocele, and small hemorrhoids, a posterior and anterior colporrhaphy, a suspension of the bladder, and a perineorrhaphy being done under ethylene anesthesia. The operation lasted one hour and eight minutes. The blood pressure during this time ranged between 140/80 and 120/70 with a pulse of 120 minutes.

At the time of operation the rectum was dilated and a small, foul-smelling plug of tissue, which was found free in the rectum, was removed. The laboratory report of this tissue was as follows: "Specimen consists of several longitudinal strips of tissue which seem to be rather smooth, having only a characteristic finely wrinkled appearance. The specimen is of highly elastic makeup. In the submucosa are found a few dilated veins."

Diagnosis.—Structure made up of supportive tissue covered by stratified epithelium and showing a number of distended blood vessels.

Following the operation the patient did well, regaining consciousness about ten o'clock. The next morning she vomited once and complained of pain in the left side. A rectal tube was inserted and about 300 c.c. of a dark brown, very offensive fluid were discharged. This looked like "old blood."

On the first post-operative day, she seemed quite comfortable. Her temperature was 100 degrees, pulse 96, respiration 20. She was able to eat and retain light foods. During the day, Jan. 7, 1930, she commenced to have diarrhea. The stools were liquid brown with a bad odor. The writer was called to see the patient.

During the following week the patient had five to eight bowel movements daily and suffered frequently from lower abdominal pain which was cramping in type. There were also some joint pains. There were occasional nausea and vomiting of clear or brownish fluid. The temperature ranged

between 101.2 degrees and 98.6 degrees with a pulse and respiration of about 80 and 20. The patient received two saline flushes daily, followed twice by acriflavin solution in a dilution of 1:5,000, and once by tannic

Dr. Lanford, the pathologist, reported it as follows: "Examination of the tissue shows it to be made up of degenerating material, no nuclei remaining. There is a suggestion of a framework of part of the intestine, but



Fig. 1. Degenerating tissue, 20 inches in length, expelled from the rectum 13 days after operation.

acid, one teaspoonful to a quart. Medication by mouth included amytal, aspirin, tolysin, and paregoric, as required for pain and to relieve the diarrhea.

Ten days after the operation, the patient was allowed to go home in an ambulance. At that time, her temperature had not been over 100 degrees in three days, but the diarrhea continued and the character of the stools had not changed.

At Home.—On January 19 a large piece of tissue, measuring 20 inches in length (Fig. 1), was expelled from the rectum.

it is not definite enough for me to determine its exact character."

The stools at this time were grayish yellow and semisolid. Increasing frequency of urination was also noted. A rectal tube which was inserted was clogged by blood the day following insertion. One-half to three-fourths pint of cottonseed oil, instilled into the rectum through the tube, temporarily relieved the pain. The temperature now was 101.4 degrees. In spite of paregoric three times a day, the pain, which was sometimes severe, and the diarrhea

persisted. The stools, which were occasionally bloody, numbered eight to nine daily.

On January 25 another piece of tissue (Fig. 2) was expelled from the rectum. This specimen, which measured seven inches,

seemed to be less tenderness on pressure over the descending colon and sigmoid. The mass-like formation in the lower abdomen was distended and there was the suspicion of a mass, which disappeared on



Fig. 2. Mass of dead tissue, having framework of an intestinal wall, measuring 7 inches, which was expelled from the rectum 19 days after the operation.

was described by Dr. Lanford: "Examination of the other section shows a mass of dead tissue which has the framework of an intestinal wall. While all the nuclei are destroyed, there is a suggestion of several coats usually found in the intestinal wall, which are the mucosa, submucosa, and muscularis."

The pain, which now was often intense, was chiefly in the left side of the abdomen. There was a great deal of flatus and the patient perspired freely. The temperature at this time reached 102 degrees, falling to 99 degrees after the slough had been passed.

On January 26 she was taken back to the hospital.

Hospitalization.—For the remainder of January there were from five to eight stools daily, these continuing to be fluid in spite of the administration of paregoric. There

manipulation, in the umbilical region. The descending colon in the midportion gave the feeling of fullness and was moderately tender. The blood pressure was 120/70 and the temperature was only slightly above normal, but the patient still suffered from pain in the abdomen and joints, was nauseated, and vomited at times.

During the early part of February, pus appeared in the stools for the first time and was never absent afterwards. There was now an even greater frequency of defecation—seven to fourteen stools daily. Sometimes these were partly formed but generally they were of liquid consistency, dark brown, containing variable quantities of visible pus, having a foul odor. On Feb. 8, 1930, a proctoscopic examination revealed the following: "Rectal palpation detects circular narrowing of rectal ampulla about $2\frac{1}{2}$

inches above anus, no mass. Proctoscopic-rectal mucosa seems normal; copious discharge of sanguino-purulent material from above. Proctoscope not higher than $3\frac{1}{2}$ inches."

Feb. 11, 1930, a barium enema was given. The fluoroscopic findings were as follows: "Following the barium enema, the barium is observed to be in the descending and part of the transverse colon. The descending colon is tremendous in size (megacolon) and there is an absolute lack of haustral marking. The barium would not pass through the ascending colon (Fig. 3). The 24-hour plate made of this colon did not give any information other than the fact that there is a marked reduction in the size of the transverse portion, and, considering the actual size of the colon, this is apparently due to residual barium."

After a rectal examination on February 17, an irregular, hard, circumscribed infiltration in the rectal ampulla about $3\frac{1}{4}$ inches from the oval margin was noted. The patient at that time complained of a sense of obstruction in the rectum.

By February 19, the daily number of stools had decreased to five or ten. Practically no fecal matter was passed except following a flush, when the expelled material had the characteristics of a constipated stool. A rectal stricture now seemed inevitable and a colostomy was contemplated. The temperature was consistently below 100 degrees and there was less pain so that the patient was allowed in a wheel-chair part of the time.

During the last of February, the abdomen became distended and more painful. The temperature rose to 101.2 degrees and there was more frequent defecation, up to fourteen times daily. The blood pressure was then 110/70.

On the morning of March 1, a colostomy was done under ethylene anesthesia preceded by morphin sulphate and atropin. The

operation, which ranged between 85/60 and 80/50, lasted one hour and five minutes and was reported as follows: "Right paramedian incision was made. Right iliac fossa was found filled with coils of small intestines and no cecum could be located.

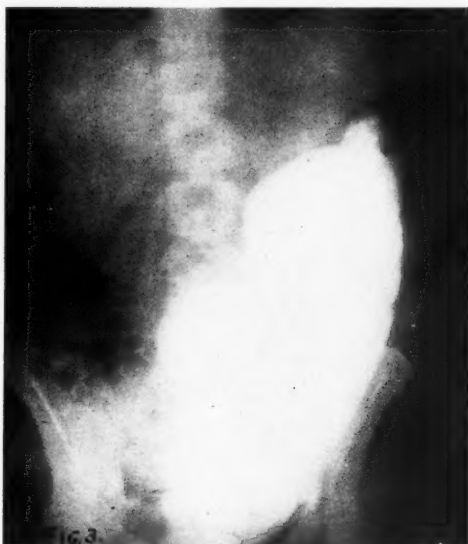


Fig. 3. The barium is observed to be in the descending and part of the transverse colon. The descending colon is tremendous in size (megacolon) and there is an absolute lack of haustral marking. The barium would not pass through the ascending colon. There is a marked reduction in the size of the transverse portion, and, considering the actual size of the colon, this is apparently due to residual barium.

Further search showed the cecum and ascending colon on the left side of the abdomen with a very long mesentery. In this area there were a number of adhesions of the sigmoid and of the abdominal wall. In detaching this, a perforation was found from which there was a free escape of feces. Paul tubes were placed in both limbs of the bowel, proximal and distal to point of perforation, and the original incision closed. The abdomen was walled off in this area as well as possible by means of several pieces of Penrose tubing."

The patient was conscious at intervals

after this but swallowing became increasingly more difficult, the temperature rose to 104 degrees, with a pulse of 156, and the respirations gradually became more shallow and slower. She died at 6:40 A. M. on March 5 from peritonitis.

Autopsy.—The body is that of a well developed, fairly well-nourished elderly white female apparently about 50 years of age. The skin, quite flabby in consistency, is a pale grayish-white color. There are large areas of ecchymoses in the skin at both creases of the elbow (sites of infusions). A foul, fecal odor arises from the body. Low in the left lower quadrant is found a semilunar opening in the abdominal wall, the edges of which are purulent and necrotic and of a grayish-green color. Two larger rubber tubes enter through this wound. Upon the right side of the abdomen is seen a closed surgical wound consisting of a linear incision about 10 cm. long. It is made over the right border of the rectus muscle and extends downward from a point just above the level of the umbilicus. Its edges have not yet united and are held together by sutures and a small amount of plastic exudate.

Abdomen.—Opened by extending the semilunar opening described previously to the xiphoid above and the symphysis pubis below. A large mass of inflammatory exudates and fecopurulent material is immediately encountered. In this are several loops of large bowel, arranged in the form of an inverted V, occupying the lower anterior one-half of the peritoneal cavity. The small intestine is displaced posteriorly and superiorly is found among the coils. The peritoneal side of the right rectus incision is inspected and found to be necrotic and covered by purulent exudate. The inflammatory mass in the left lower quadrant is now explored and dissected with great difficulty, due to the spill of the fecal material through the openings, made at operation, in the sigmoid colon. These openings are no longer

present as such. In their place are found extensive necrosis and slough, so marked as to interfere with the identification of the segments of colon. A loop of the transverse colon is plastered and matted in the exudate at a point where a part of the sigmoid has sloughed away. The rectum, sigmoid, and lower transverse colon are now removed. We find a complete loss in the continuity of the wall at a point 8 inches above the anus. The edges of the approximal segment, which are ragged and friable, are covered by necrotic material of a dirty yellow-gray color. The upper margin of the distal segment, which is thickened at one point and seems to be constricted, is undergoing a necrotic change. Upon opening the lumen of that part of the colon which is yet intact, we find the mucosa of the descending and lower transverse colon presents irregular patches of ulceration and necrosis. At one point in the descending colon, a complete slough of the wall has occurred. The ulcerated areas are markedly irregular although of a somewhat stellate or lineate design in most places and of a dirty grayish-white color. The mucosa of the rectum is irregular and edematous, varying in color from a grayish-brown to a purplish-red. Swollen patches of deep red color are present. Both fallopian tubes are edematous, thickened, and congested. The ureters are also inflamed and thickened, and the peritoneum overlying them is covered by a thick, creamy exudate.

Spleen.—Small and of a dirty slate color. The capsule is slightly thickened. The pubis is soft, friable, and of a purplish-red color.

Liver.—Slightly enlarged. The left lobe, covered by purulent material, is of a dull gray color. The remainder of the organ is of a yellow-brown color, slightly mottled.

Gall Bladder.—Walls slightly thickened and of a dull grayish-white color. It is emptied with difficulty.

Kidneys.—Small, with thickened capsules. The cortices are thin and of a pale, grayish-red color except for the pin point deep red dots of the glomeruli, and the congested vessels of the pyramids.

Adrenals.—Negative.

Pancreas.—Negative.

Anatomic Diagnosis.—(1) Surgical wound of the abdomen; (2) colostomy (of sigmoid); (3) general peritonitis, chiefly involving the left lower quadrant; (4) extensive ulceration and necrosis involving the rectum, sigmoid, descending, and transverse colons; (5) complete loss in continuity of the sigmoid with spill of fecal contents; (6) evidence of stricture of the colon at the level of the rectosigmoid junction; (7) acute splenitis; (8) fatty degeneration of the liver; (9) chronic cholecystitis; (10) acute perinephritis; (11) terminal toxemia.

Microscopic Diagnosis.—The intestinal wall is made up of new connective tissue with a thin layer of muscle. There is no epithelium. Granulation tissue and some acute exudates are seen on the serous coat. Other areas of the intestine show ulcerative enteritis. The kidneys show cloudy swelling. There is some increase in the thick-

ness of the blood vessel walls. Some of the tubules show hyaline casts.

SUMMARY

Because of the rare occurrence of such instances, a case of spontaneous elimination of intestine with recovery is reported in detail. Certain features of the author's case were most exceptional and have not formed a part of the description of other cases reviewed in the past fifty years. It is unusual for the prodromal symptoms to precipitate following the administration of a soap-suds or other type of enema. Comparatively few instances of spontaneous elimination of intestine in individuals past middle life have been reported. The present case is unique because two separate segments of intestine were given off through the rectum at different times.

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THE ROENTGEN DIAGNOSIS OF DUODENAL DIVERTICULA

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THE increasing frequency with which diverticula are being found in the duodenum in the course of routine roentgen examinations of the intestinal tract provokes study of the diagnostic signs of this lesion. References to this phase of the subject are less frequent than are the references to the surgical treatment of the condition. Case's early work in 1913 and his later essays on the subject have laid the foundation for the roentgen diagnosis of duodenal diverticula. Since that time, various workers have reported on the pathologic, clinical, surgical, and roentgen phases of the subject. It is not within the scope of this article to evaluate the surgical importance of duodenal diverticula or to determine in what percentage of cases they are responsible for symptoms; the intention is merely to review some of the characteristic roentgen findings and to illustrate the various radiographic images encountered.

INCIDENCE

The frequency of the lesion varies according to different observers, from 0.5 to 5 per cent, depending largely on whether it is noted during roentgen examinations or at the autopsy table. In 1920, Case (4) found 85 cases in 6,847 gastro-intestinal studies. Andrews (2) in 1921 found 1.2 per cent in 2,000 X-ray examinations. Only recently Albrecht (1) reported having observed 50 cases personally. It is thus seen that diverticula occur frequently enough to warrant a constant outlook for them.

PATHOLOGY

Various autopsy and operative reports show that the diverticula are essentially pouches or protrusions from the duodenal

wall, having a free communication with the duodenal lumen, and varying in structure according to the duodenal coats involved, the musculature usually being the most deficient component. This lack of musculature was formerly regarded as an important pathologic criterion, but a recent paper by Odgers (25), whose accurate descriptions are typical of English thoroughness, offers a revised classification which appears rather logical. Odgers classifies duodenal diverticula into (1) primary pouches—arising without any coincident pathology and confined to the duodenum beyond the first portion; (2) secondary pouches—due to chronic duodenal ulcers or adhesive band traction and occurring only in the first part, and (3) Vaterine pouches associated with biliary papillæ.

Pancreatic tissue may be found in the diverticula (2, 4). Conversely, the diverticula are often embedded in the pancreas, making surgical removal at times impractical, if not impossible (4).

In those cases associated with duodenal ulcer, the composition of the diverticular wall may be the same as in the primary diverticula. The shape of the secondary diverticula may, of course, vary in size and contour according to the amount of adhesive tissue attached to them. In the secondary pouches associated with duodenal ulcer, the major portion of a perforated ulcer may be found in the diverticulum, or ulceration may occur in the diverticulum itself. Henderson (10) has observed four cases in which ulceration was found in the diverticulum at operation. The writer was privileged to observe fluoroscopically one of these cases in which definite irregularity of the diverticular wall could be seen.



Fig. 1-A. Large diverticulum of third portion of duodenum, oblique position. (Retouched.)



Fig. 1-B. Same case, compression technic.

In some cases, the diverticulum is situated on the opposite wall from the duodenal ulcer. Jones (14) reported a case of tubular diverticulum of the first portion of the duodenum, with an ulcer on the opposite wall. Dickey (6) reported such a case in a boy aged 13 years, in whom were found at operation a diverticulum, adhesions at the pyloroduodenal junction, and an ulcer scar on the duodenal wall opposite to the diverticulum.

Morrison and Feldman (21) reported a first portion diverticulum in the wall of which was a small, primary, carcinomatous mass.

Gallstones have been reported as found in diverticula, but usually in secondary pouches where there was a communication between the gall bladder and the diverticulum (5, 12).

While the literature contains few descriptions of diverticulitis and peridiverticulitis such as are noted in connection with colonic diverticula, it is stated that these conditions do occur (22). It is possible that the difference in the duodenal and colonic flora, as well as the difference in the nature of the material retained in the diverticula in these two locations, may account for the fewer re-

ported inflammatory conditions in connection with duodenal diverticula. The smaller incidence of duodenal diverticula is also to be considered.

Perforation of the diverticulum may occur here as in the colon. Monsarrat (19) and Lucinian (18) have noted this.

This résumé of the pathology of colonic diverticula is given in order to establish a basis for the various radiographic images encountered, and it is, therefore, necessarily somewhat abbreviated.

ROENTGENOLOGIC DIAGNOSIS

The first important point in the roentgenologic diagnosis of duodenal diverticula is to look for them. The author's first case was found the day after reading some literature on the subject, and since then he has been on the alert for this lesion.

Method of Examination

1. *Media.*—It is wise to avoid the immediate administration of large amounts of barium mixture. It is much better to use a small amount of a thin mixture, supplemented later by the bulk of the meal. If

there is pylorospasm, the addition of sodium bicarbonate or the preliminary use of atropine sulphate (gr. 1/75) hypodermically may be of value. The use of acacia, as in esophageal examinations, should be avoided, for it may give false information as to the degree of retention of contents, if any pouches are found.

2. *Fluoroscopic Examination.* — This should be carried out in the vertical and horizontal positions. Oblique views should also be utilized. If there is observed what appears to be a small pouch, it is well to turn the patient so that the back is next the screen, to magnify details. In busy laboratories, patients are often observed before the vertical screen and then passed to the filming room. When this is done, duodenal lesions beyond the bulb may be easily overlooked, even by competent workers. The time and labor necessary to horizontal observation will well repay the observer in a harvest of otherwise unobserved lesions.

Since diverticula may be very small, it might be well to repeat here the ancient caution to spend enough time to obtain good dilatation of the pupils prior to every observation. The use of accommodation goggles made of red celluloid will be a help to the worker who is obliged to make his observations in the intervals between procedures requiring a lighted room.

Case's method of blocking the duodenum with one hand while expressing barium from the stomach with the other is valuable (4). In the prone position, rocking the patient from right to left and *vice versa* will often aid in filling the entire duodenal lumen. To visualize the terminal duodenum and the duodenojejunal junction, the table may be lowered to a semi-Trendelenburg position, thus throwing the stomach above the duodenum and leaving an unobstructed field. In one case, a duodenal pouch was filled in this position only.

The writer's experience with fluoroscopy

under compression is so limited as to leave him void of any authority on the subject, but films have been made in this position, and they will be referred to later.

The use of a duodenal tube for filling the duodenum with barium is strongly recommended by some. Heacock (9) makes the following statement: "In the differential diagnosis, no procedure is more important than the filling of the second, third, and fourth portions of the duodenum with barium through a duodenal tube." McKinney (22), in a more recent paper, states that the use of the tube is advisable in doubtful cases.

Film Examination

In duodenal study, as elsewhere, the best general rule to follow is to attempt to duplicate on the film the position in which lesions were best observed during fluoroscopy. Visualization of the duodenum in the right oblique horizontal position is very helpful, and most diverticula, even those originally hidden by the stomach shadow, can be well demonstrated in this position. This procedure is also an aid in distinguishing duodenal redundancies from diverticula, although, as stated by Larimore and Graham (16), fluoroscopic palpation is necessary in making such differentiation. The technic and advantages of right oblique radiography have been given in a previous article (27).

The Bucky diaphragm is useful in thick patients, and, with the more rapid technics now available, there is usually little blurring due to peristaltic motion or respiration.

In one of our cases (Figs. 1-A, 1-B), the author employed compression with a rubber bag and the Bucky compression strap. The effect was to express barium from the adjacent gastric shadow and to some extent from the duodenal loop, but to leave the diverticulum well filled. While sufficient

experience with this method has not been accumulated to warrant positive statements, it has occurred to us that this compression may be one means of deciding if the diverticulum is embedded in the pancreas. It is

abnormal cases by use of the Cinex camera as developed by Jarre (13). Since such intricate movements as the contractions of the bronchi and kidney pelvis are so well demonstrated by this method, the phenomena of



Fig. 2. Pseudo-diverticulum just beyond bulb, due to adhesions.

conceivable that the surrounding hard pancreas might furnish protection against the compressing force, so that barium could not be squeezed out of the pouch. This observation needs further investigation before being established as of any definite worth. Its value, if any, would probably be limited to those large diverticula with fairly wide mouths.

Serial radiography may furnish information of value, and the appearance of diverticula in filling and emptying phases should be studied. In this connection, we wish to make comment upon the possibilities of the study of duodenal peristalsis in normal and

duodenal movements should be easily observed. The process by which barium occasionally fills the ampulla of Vater might be studied, and more light thrown upon the possible ascension of duodenal contents in the bile and pancreatic ducts, with perhaps consequent choledochus and pancreatic infection.

The demonstration of peristaltic waves in suspected pouches by means of serial studies would be valuable in distinguishing redundancies and false diverticula from true diverticula, because true diverticula usually lack musculature sufficient to transmit the peristaltic wave (Fig. 2). In this case, the

pseudo-pouch noted in the duodenum was found at operation to be due to redundancy of the duodenum, caused by adhesions.

Suggestive Roentgen Findings

The roentgen findings stated by Case, in

We wish to emphasize the importance of explaining the cause for rounded lumps of barium remaining in the upper abdomen after the stomach and upper bowel are empty. These lumps may represent diverticula which were either overlooked at the



Fig. 3. Multiple diverticula, with pseudo-pouch above them.

1920 (4), as being suggestive of diverticula hold good to-day. They are as follows:

1. A more or less spherical shadow lying in or near the concavity of the duodenal shadow; some are found on the convex side.
2. Identity of this shadow as being separate from the duodenum, yet in definite relation to it.
3. Sometimes persistence of the shadow for hours, or even days, after clearance of the stomach.
4. In certain cases, movability of the shadow about a fixed point in the epigastrium.
5. Usually no point of tenderness coinciding with the shadow, though this is by no means always true.

initial examination or which did not fill immediately. Whenever such a barium lump is noted, particularly if it is rounded in character, the stomach and duodenum should be refilled, in an effort to identify the lump. If no duodenal diverticulum is found, then it will be well to observe the patient at frequent intervals to determine if the lump can be identified with a small intestinal diverticulum.

TYPES OF DIVERTICULA, WITH VARIATION IN ROENTGEN APPEARANCE

Following Odgers' (25) classification of primary, secondary, and Vaterine pouches,

we will now discuss the various shapes and locations of diverticula.

Practically all of the primary type occur beyond the first portion. Usually they are rounded or ovoid, or funnel shaped. The tubular form is said to be uncommon; such a shape was found in Jones' case (14) but it was associated with an ulcer on the opposite wall and probably was of the secondary pouch type. The primary type may be multiple. The neck may be of varying length, being often so short and the ostium so wide that one is in doubt as to whether he is dealing with a true pouch or a mere redundancy of the duodenal wall. One of our cases (Fig. 3) presented three rather shallow diverticula on the concave surface of the loop, and above them there was a duodenal fold very closely simulating the diverticula on the film, but identified as a fold by fluoroscopy. At operation, the fold was demonstrated as such, but the diverticula were not; however, the retroduodenal space was not explored, due mainly to the extreme obesity and only fair general condition of the patient. The gall bladder was found normal. A diseased appendix was removed. However, in spite of careful medical treatment, the postprandial emesis and belching, of which the patient complained when first seen, persisted after operation, suggesting a causal relation of the diverticula to the symptoms. There was no retention of contents for longer than four hours. The patient later committed suicide, but no autopsy was obtained.

The rounded type, with definite stalk, is rather common. As alluded to by Heacock (9), the ostium may occupy a position above the pouch, thus favoring retention of the contents. This is well illustrated by Figure 4, taken from a previous report (26). In this case, barium was retained in the pouch for 48 hours. The patient refused operation, and her symptoms have



Fig. 4. Primary first portion diverticulum, ostium uppermost.

persisted to some extent for three years since the time of her last examination. Re-examination recently showed the pouch to be no larger than formerly, and the retention time not prolonged. There is room for doubt as to the casual relation of the diverticulum to her symptoms.

The small globular or oval type of diverticulum, so commonly observed in the colon, is not so often seen in the duodenum. Two such cases have been observed by us (Figs. 5-A, 5-B.)

The diverticular lesions secondary to duodenal ulcer or adhesive bands may present as many variations as the adhesions see fit to create; we cannot predict their conformation with any certainty. An irregular or pointed outline of the pouch should make one suspicious that it is of the second-



Fig. 5-A. Tiny globular diverticulum.

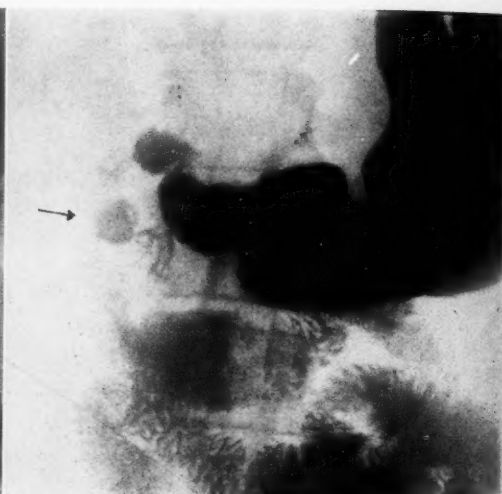


Fig. 5-B. Larger, rounded diverticulum.

ary type (Fig. 6), or, if symptoms indicate, of perforation.

DIFFERENTIAL DIAGNOSIS

Duodenal diverticula must be differentiated from:

(A) *Barium-filled Shadows:*

1. Ulcer craters—perforated gastric or duodenal ulcers
2. Redundancies (congenital or due to adhesions)
3. Traction pouches due to adhesions
4. Vaterine pouches
5. Jejunal diverticula
6. Barium retained in colonic haustrations or a diverticulum, following a previous examination (22)
7. Duodenal ileus

(B) *Shadows not Caused by Barium:*

1. Gallstones
2. Renal stones
3. Fecaliths
4. Calcified glands
5. Pancreatic calcifications

Barium Shadows

1. Perforated gastric or duodenal

ulcers. Usually in relation to the first portion; concomitant signs of ulcer; irregular outline.

2, 3. Redundancies, congenital or due to adhesions, and traction pouches.

In these, a definite neck, or ostium, is usually lacking. The pouches due to adhesions are usually irregular in outline, and more often shallow. Careful fluoroscopic study or serial films will usually demonstrate the presence of peristaltic waves, which are usually absent in diverticula. At times, differentiation is impossible except at operation. Larimore and Graham's article (16) is an excellent one on this point, and it should be carefully studied by those interested. Heacock's observation (9) is a reliable guide here: "No more important point can be raised in the differential diagnosis than a study of the ostium and the demonstration of a back-and-forth flow of the medium from the lumen of the duodenum to the cavity of the sac." Filling of the duodenal lumen through a tube is helpful.

4. *Vaterine Pouches.*—The frequent occurrence of diverticula near the site of the ampulla readily causes confusion. Perhaps

the greatest difficulty arises from the lack of definite knowledge as to what is the typical shadow of a filled ampulla of Vater. Descriptions (Fig. 7) in the literature vary from "collar button," to "clover leaf," to

ing the shadow of the barium as it descends in the second portion of the duodenum it can be frequently observed to pass outside the lumen at this point and remain as a small fleck. Second, the size of the shadow



Fig. 6. Irregular, pointed, secondary type diverticulum.

tubular. Baensch (quoted by Odgers, 25) says that the fundus of a Vaterine papilla will be parted into two little bays, corresponding to the termination of the bile and pancreatic ducts. Duval, Roux, and B  cl  re (7) describe and illustrate a "collar button" (Fig. 8), and also mention a "clover leaf" appearance, but warn that intrapancreatic diverticula may simulate the filled Vaterine ampulla. Heacock (9) states that no reliable method of differentiating diverticula and dilated ampull   exists. Henderson (10) uses two criteria: "First, in watch-

will frequently serve to determine the question, barium in the ampulla of Vater being rather smaller than the average diverticulum." The last named criterion seems to the writer a rather reliable one. Henderson also describes the filled ampulla as "comma-shaped" (Fig. 9).

In attempting to formulate an anatomic basis for the variation noted in the filling of the ampulla, one is met by the problem of the different modes in which the pancreatic and common bile ducts join the ampulla. One anatomic variation, the entrance



Fig. 7 (upper left). Tubular Vaterian ampulla.

Fig. 8 (upper right). Collar-button or dumb-bell Vaterian ampulla.

Fig. 9 (lower left). Comma-shaped Vaterian ampulla.

Fig. 10 (lower right). "Dimpled" Vaterian ampulla.

of the pancreatic and common bile ducts at different points in the duodenal wall, need not be taken into consideration, since the shadows under discussion are extra-luminal. No illustration of paired tubular projections from the barium shadow of the duodenal lumen has been encountered in the literature at our disposal, though such a filling is not impossible. It is the usual occurrence for the papilla to project slightly into the intestinal lumen, and any dilatation noted must exist outside of the wall. Nagel (24) presents a drawing from a dissected specimen

showing two small diverticula near the common duct. Such diverticula might easily explain the biloculated or collar-button shape commonly noted and ascribed to a Vaterian ampulla.

Occasionally the writer has observed in the region of the ampulla an extra-luminal shadow consisting of a small barium mass with two distinct "dimples" (translucent areas) within it (Fig. 10). While operative confirmation of this theory is lacking, it is conceivable that the barium mass might represent a dilated ampulla, and that the

two dimples, or translucent areas, are due to projection into the ampulla of the mouths of the pancreatic and bile ducts, these ducts being closed and admitting no barium. The shadow produced would be similar to that

tract, they may occur elsewhere, and to stress the importance of complete studies from mouth to rectum. The duodenum was not explored in this case, since there were no upper abdominal symptoms.

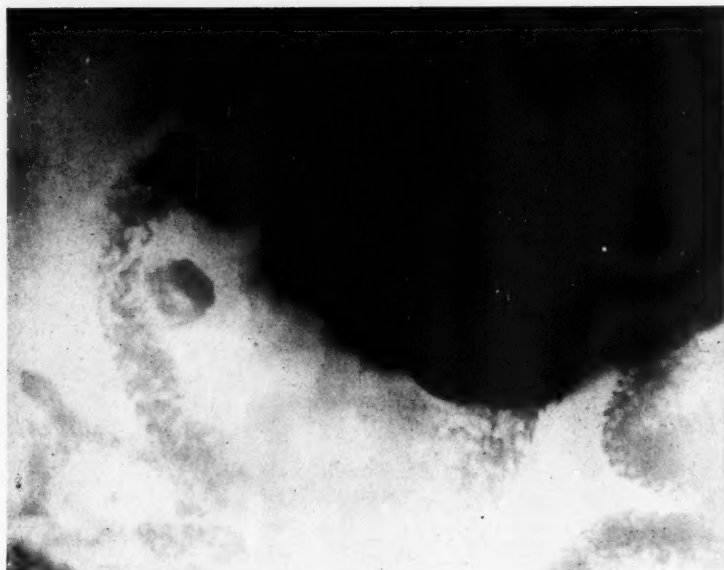


Fig. 11. Shadow with filling defect, similar to Figure 10, interpreted as a diverticulum. This may be a filled ampulla.

caused by a polypus within the duodenal bulb. In one of our cases, a similar shadow was seen (Fig. 11), but it was interpreted as a true diverticulum, because of the rounded sac and definite neck, both neck and sac being seen, under the fluoroscopic screen, to fill from the duodenal lumen. This patient also showed multiple diverticula of the sigmoid, with partial obstruction at the site of the diverticula. At operation, the sigmoid diverticula were found, together with an inflammatory edematous mass, which was causing the obstruction. Histologic examination of the resected mass showed no evidence of malignancy. This detail is mentioned to show that, when diverticula occur at one point in the intestinal

In two reported cases of filling of the common and hepatic ducts by barium, neither the collar-button nor the clover-leaf form of the duct shadow is noted. Beall and Jagoda (3), in reporting a case of accidental filling of the bile ducts with barium in a patient who vomited severely, presented reproductions of films, but the above-mentioned shapes of the ampulla are not found in the reproductions. Habbe and Smith (8) also reported a case of bile duct visualization by a barium meal. In their illustrations, a smooth duct outline is noted on the immediate film; two hours later there is beading of the common duct near the duodenum, and at four hours a still different shadow obtained. This would suggest

that the shape of the common duct shadow would depend somewhat on the degree of filling with barium.

From a review of the literature and from personal observations the following conclu-

(e) Filled ampullæ usually empty sooner than diverticula.

(f) There is need of further investigation of this point in order to establish definite roentgen criteria. The writer

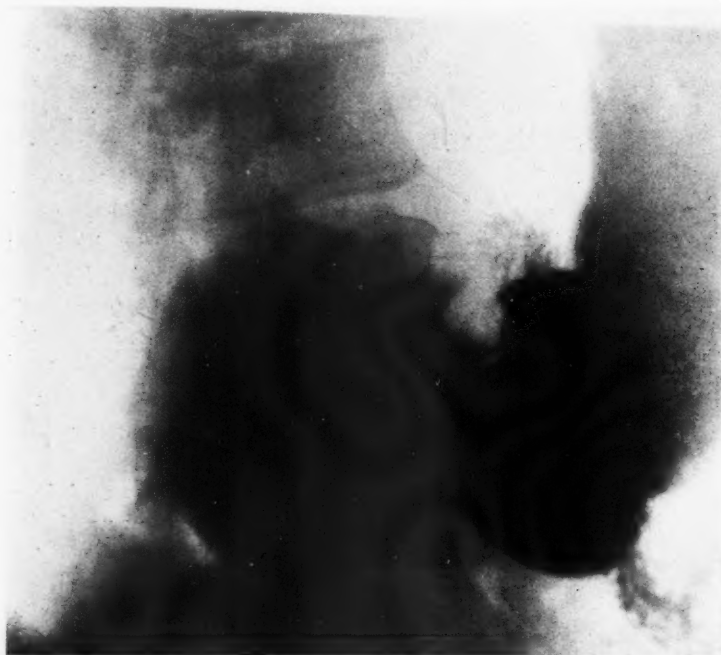


Fig. 12. Duodenal ileus, resembling large diverticulum. Oblique position.

sions are drawn in regard to the appearance of the filled Vaterian ampulla:

- (a) The shadow is always on the concave side of the second portion of the duodenum.
- (b) It is usually smaller than a diverticulum.
- (c) No constant shape is obtained.
- (d) A small barium fleck, a short tubular shadow, a small barium mass with two translucent areas within it, and a biloculated or dumb-bell shaped shadow are probably the most characteristic shadows of filled ampullæ.

suggests that radiographs be made upon autopsy subjects, after injecting the ampulla with barium.

5. *Jejunal Diverticula*.—These may be confused with third portion diverticula of the duodenum. Careful fluoroscopic observation, using a small barium meal, will usually suffice to distinguish them. The semi-Trendelenburg position for radiography, previously mentioned, should also be helpful here.

6. *Barium retained in colonic haustrations or a diverticulum, following a previous examination*.—Any confusion from this

source can usually be eliminated by taking a careful history, and by "scout" fluoroscopy of the abdomen prior to administration of barium. If shadows of the density of barium are noted, and there has been no exami-

case, careful fluoroscopic study with a small meal revealed the true condition. Howard (12) reported a case of duodenal obstruction, due to annular pancreas, in which a roentgen diagnosis of diverticulum was



Fig. 13. Duodenal dilatation, simulating diverticulum. Examination three years later did not show this amount of dilatation.

nation with the barium meal or enema, then the possibility of bismuth medication should be investigated. In either case, a cleansing enema will remove the problem.

7. *Duodenal Ileus*.—The ileus, secondary to obstruction, may simulate a large diverticulum, especially on films. This is particularly true when the dilatation has proceeded to the point at which the normal valvulae conniventes are thinned out, producing a smooth wall. This possible confusion is illustrated by Figure 12. In this

made prior to operation. Reproductions from the film, kindly loaned to the writer, very much resemble Figure 12. Our case has not come to operation, since the duodenal stagnation is not prolonged. Figure 13 illustrates a similar condition.

Shadows Not Caused by Barium

There should be little difficulty in distinguishing calculi, fecaliths, and calcifications in this area. Pancreatic calcifications

are rather rare. None of these shadows possesses quite the density of barium, and the lack of demonstrable connection with the duodenal lumen by a barium flux should serve to differentiate even the more dense of these shadows.

COMMENT

The chief factors in the diagnosis of duodenal diverticula are:

1. To look for this lesion.
2. A knowledge of the pathology of this and confusing lesions.
3. Careful fluoroscopic observations.
4. Films duplicating as nearly as possible the extra-luminal barium shadows seen under the screen.
5. Familiarity with the roentgen appearance of this and confusing lesions.

SUMMARY

1. Study of the roentgen findings in duodenal diverticula was prompted by the increasing number of cases reported in the literature.

2. The incidence and pathology of duodenal diverticula are briefly reviewed.

3. The roentgenologic diagnosis of duodenal diverticula is discussed with reference to:

- (a) Media used
- (b) Fluoroscopy
- (c) Radiography
- (d) Suggestive roentgen findings
- (e) Types of diverticula, with variations in roentgen appearance.
- (f) Differential diagnosis.

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STEREOSCOPIC X-RAY DEVICE PEERS INTO LIVING BODY

A stereofluoroscope X-ray instrument that shows the inner workings of the human body as though it were a moving picture has been perfected at the California Institute of Technology and will be forwarded to the Henry Phipps Institute, at Philadelphia, where practical medical experiments are to be conducted.

Several months ago a rough experimental model was completed which caused great interest when introduced to the medical world. When it proved a success, funds were secured from the Rockefeller Foundation for construction of a more elaborate instrument designed for use in hospitals.

The instrument was developed by Dr. J. W. M. DuMond, research fellow in physics, Dr. Archer Hoyt, teaching fellow in physics, and Clarence Brandmyer, at the California Institute of Technology. Dr. Hoyt will become an instructor at Cornell. These men worked out the details of the instrument, which was built at the institute.

The instrument consists of two X-ray tubes connected to a single transformer so that they are alternately caused to emit X-rays by alternations of a fifty-cycle alternating current. The alternate X-ray impulses emitted by the tubes project alternate shadow pictures of the object to be viewed on a single fluorescent

screen. Since tubes are spaced apart at approximately the same distance as the distance between the two eyes, the shadow pictures projected on the screen differ slightly in the point of view in the same way that two images in the right and left eye differ respectively from each other when the eyes view any object in three dimensions.

To give the impression of a three-dimensional stereoscopic plastic relief, it is only necessary to arrange that each eye shall see one, and only one, of the two images formed by the two tubes. This is accomplished by means of a special rotating shutter placed before the eyes, driven by a synchronized motor in such a way that the right eye looks at the time the right-hand X-ray tube is emitting rays and the left eye looks at the time the left tube is emitting.

By observing certain geometric relationships between parts it is possible to have the stereoscopic image appear in space in front of the screen as an exact scale reproduction. Calipers are provided that can be introduced into the image and brought into apparent contact with any two parts of the image whose separation or size is desired.

Scale measurements on the inside of the human body can be made in height, breadth, or depth, or, in fact, any direction whatever.—*Science Service.*

TECHNIC IN PELVIC IRRADIATION¹

By HENRY SCHMITZ, M.D., CHICAGO, ILLINOIS

THE criteria of an adequate radiation tissue dose delivered into a carcinoma are a rapid resolution of the growth, a restoration of the normal surface epithelium, and a limited fibrosis. From clinical observations it appears: (1) that a uniform or homogeneous distribution of the radiation intensity of known dosage throughout the invaded area is desirable, and (2) that the tissue dose should be lethal to the carcinoma cells. Thereby a greater permanency of good end-results and a decrease in the number of primary failures are achieved. The good end-results, however, depend not only on a homogeneously distributed and lethal radiation tissue dose, but also on the anatomic or clinical extent of the tumor, the location of the growth, the degree or grade of the histological malignancy, and the presence or absence of a complicating infection. This paper will deal solely with the technic of the application of rays in cancers of the pelvic organs, namely, the uterine cervix, the uterine body, the ovaries, the urinary bladder, and the rectum and sigmoid.

The lethal radiation tissue dose for carcinomas and sarcomas has been determined by Wood and Prime (1) in animal experiments. They concluded therefrom that the radiation dose to kill all the cells of a rapidly growing, highly cellular and malignant sarcoma or carcinoma in man is probably between 5 and 7 E.D. of filtered roentgen rays applied to the tumor. Wood (2) further states that the production of absolute permanence of cure by radiation therapy implies that the destruction of the tumor cells must be as complete as must be their removal for effective surgery.

Martin and Quimby (3) reported ten cases of intra-oral malignant growths of various cell types successfully treated with radiations and found the lethal or superlethal tissue dose for squamous-cell cancers to be about 10 E.D., and for transitional-cell cancers to be about 2.5 erythema doses. Squamous-cell cancers are usually associated with a high degree of differentiation, that is, they are more mature and radioresistant, while the transitional-cell cancers are, as a rule, accompanied by a high degree of undifferentiation, that is, they are immature and highly radiosensitive, and the spindle-cell cancers are characterized by a high degree of undifferentiation.

Meyer (4) states that one should not forget that the histologic structure of a tumor is a transient picture and at a later examination an entirely different histologic picture may be obtained. Also carcinomas present mostly a mixed-cell picture and the malignant adenoma, adenocarcinoma, and solid adenocarcinoma, as well as the spindle-, round-, and prickle-celled solid carcinoma, really represent the predominating cell type at a given biopsy which may have changed at a subsequent examination to a predominance of other cell types. Hueper and the writer (5), therefore, determined the degree of histological malignancy from the degree of differentiation or undifferentiation as suggested by Broders and corroborated by Greenough and others. The special characteristics and structure of the cells, the cytoplasm, the nuclei, and the stroma were considered in the determination of the malignancy index. The radiosensitivity increases with the increase in the degree of undifferentiation and decreases with increase in the degree of differentiation. The highest degree of immaturity gave index values of 68

¹Read before the Radiological Society of North America at the Sixteenth Annual Meeting, at Los Angeles, Dec. 1-5, 1930.

to 80; the next grade group, 54 to 67; the next grade group, 42 to 53, and the mature group had values of 30 to 41. These values are, of course, relative. But the lethal tissue radiation dose for the most mature

or anatomical extent of the growth. *Location* determines the organ or tissue involved, as, for instance, the mucosa of the rectum, with or without involvement of the muscular coat or the perirectal tissue and its ap-

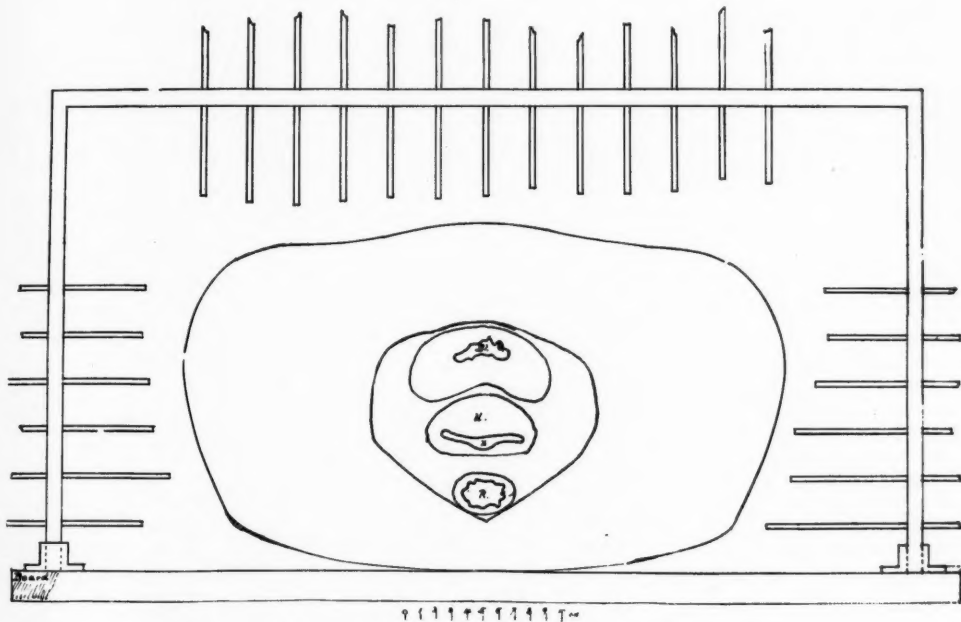


Fig. 1. Caliper to obtain the topography of the pelvis and hips.

group with good end-results was about 4 to 5 E.D., and for the most immature group about 2 to 2.5 erythema doses.

The methods of applying radiations are: (1) the cavitary; (2) the interstitial, and (3) the distant or *tele* methods. The sources of radiation are radium, radon, and roentgen rays. The dosage factors which are required for the evaluation of the dose of radiation delivered to a tissue are: (1) location of tumor; (2) size of tumor; (3) depth of tumor; (4) strength of radio-active source; (5) distribution of radio-active source; (6) filtration; (7) distance or spacing, and (8) duration of application (*see* Ref. 6).

Location, size, and depth of the tumor are obtained by the determination of the clinical

proximate seat as anterior, posterior, or lateral wall or an annular extent; involvement of regional lymph nodes, adjacent or distant organs. The *size* should state the approximate diameters in the three dimensions. The *depth* of the tumor should indicate the relation of the growth to the surface of the body. In pelvic carcinomas, these findings may be expressed on transverse and longitudinal sections of the pelvis through the center of the growth. Calipers (Fig. 1) aid in obtaining the exact outline, and a specially constructed pelvimeter determines the exact location and size of the growth within the pelvis.

The *strength of the radio-active source* should be stated in milligram radium element hours or in millicurie radon hours

with allowance for decay. The distribution of the radio-active source should describe the construction, shape, and dimensions of the applicator. *The effective length of distribution of the radio-active material in tubes*

recorded by means of a diagram. Lastly, the duration of each séance, with the interval of time following each, should be given, and each recorded separately.

The factors in roentgen therapy include

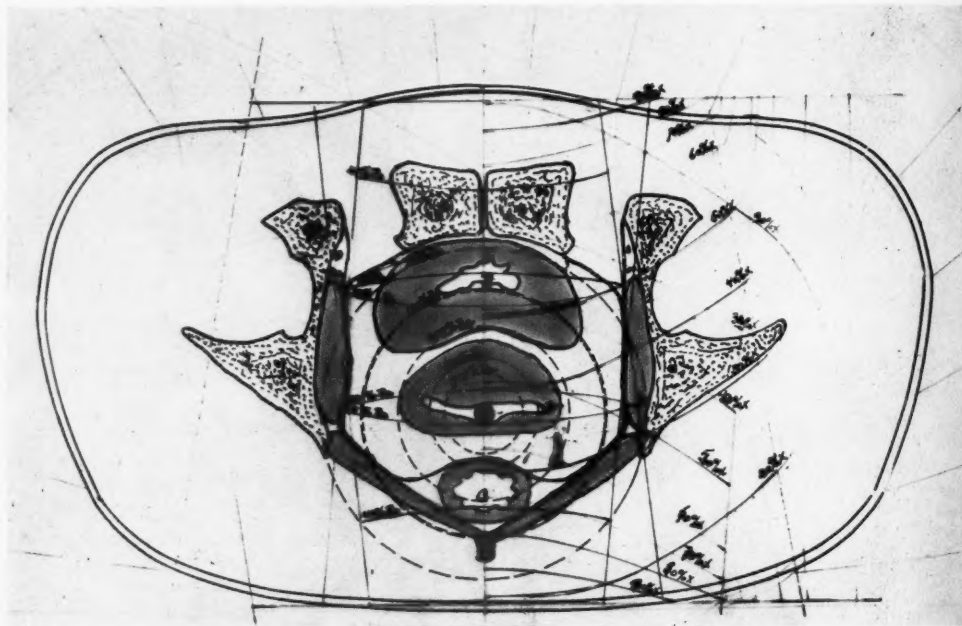


Fig. 2. Transverse section through female pelvis just above symphysis pubis. (See Fig. 3.)

or needles should be given. The *filtration* should designate all the materials between the radio-active substance and the tumor, as the kind and thickness of metal, rubber, leather, paraffin filters, and the approximate thickness of the tissues from the surface to the tumor.

Distance is one of the most important factors in radiation therapy. It should be measured from the center of the source to the surface of the tissue or skin. In interstitial radiation, it is important to state the spacing. Hence the number of needles or implants, strength of each, and thickness and kind of metal container should be recorded. If cross-firing is used, then location, size of fields, and focal skin distance should be re-

the source type of generator and tube, wave length, kilovoltage, milliamperage, size and location of field, filtration, focal skin distance, and duration and date of each treatment. The total dosage should be expressed in E.D. or r units.

THE TECHNIC OF COMBINED RADIUM AND ROENTGEN TREATMENT

Carcinomas of the Cervix

The technic is carried out: (1) by the cavitary method, namely, the insertion of 50 mg. radium element filtered with 2.0 mm. brass and 2 mm. Para rubber; (2) by teletherapy, *i.e.*, the external application of short wave X-rays and radium. Figures 2 and 3 illustrate the method. The intra-

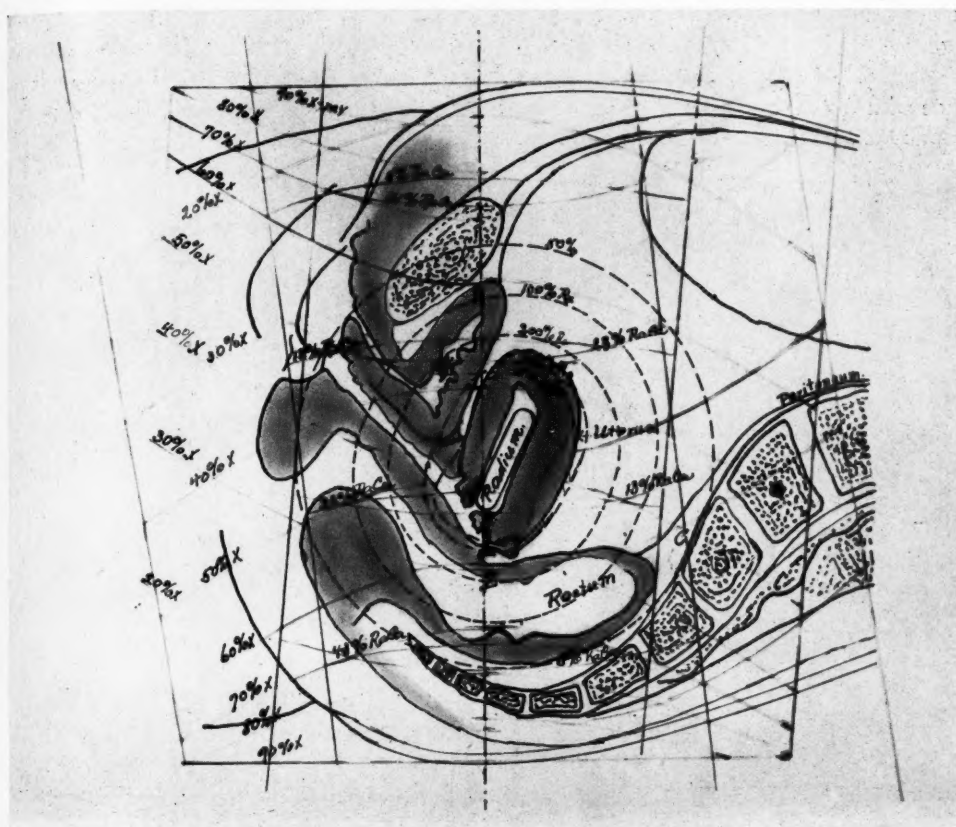


Fig. 3. Median longitudinal section through female pelvis.

Equal intensity curves from radium capsule placed intra-uterine are designated 50, 100, 200, 400, and 600 per cent, respectively, and drawn in interrupted lines.

Equal intensity curves from radium cannon through an anterior and a posterior port of entry are designated 43, 23, and 13 per cent, respectively, if 100 per cent is the surface dose.

Equal intensity curves of X-rays obtained through an anterior and posterior field are designated 90, 80, 70, 60, etc., per cent. "A" designates posterior bladder wall. "B" designates lateral uterine wall. "C" designates anterior rectal wall. "D" designates lateral bony pelvic wall.

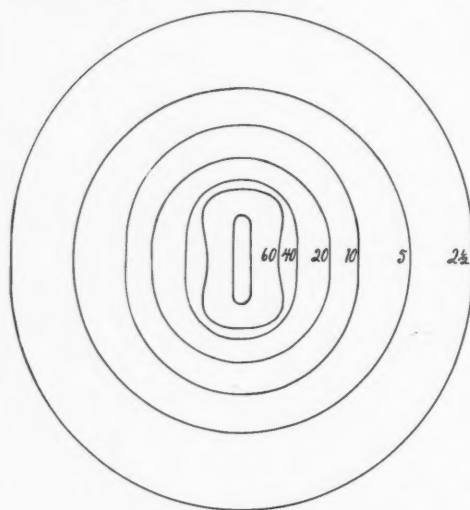
uterine radium application dose is 4,500 to 4,800 mg.-el.-hrs., obtained by three insertions of 30 to 32 hours at 8-day intervals.

The equal intensity curves of radium measured in water are seen in Figure 4. Patterns made from these isodoses facilitate the plotting on longitudinal and transverse sections of the pelvis (7). The patient during the first insertion is placed under gas anesthesia so that proper dilatation of the cervical canal may be done and a piece of tissue may be obtained for biopsy.

The factors of the X-ray treatment are: kilovoltage 211; large size water-cooled Coolidge treatment tubes; filter 0.75 mm. copper plus 1.0 mm. aluminum; target skin distance 65 cm.; size of fields 20 sq. cm.; number of fields, 2 to 4, depending on size of anteroposterior diameter of pelvis. The depth dose at 10 cm. measured in the water phantom is about 48 per cent of the surface dose. The applied skin dose is 1.5 E.D. to each field if 1.0 E.D. represents the erythema dose defined by Martin and Quimby.

The equal intensity curves are shown in Figure 5.

The radium distance applications are made with the radium cannon, the construction and equal intensity curves of which are



1 2 3 4 5 6 7 8 9 10

Fig. 4. Equal intensity curves of 50 mg. radium element filtered with 2 mm. brass measured in water.

shown in Figure 6. The threshold erythema dose is obtained with 24 gr.-el.-hrs. if applied in one sitting and with 32 gr.-el.-hrs. if applied within 10 to 14 days and at a focal skin distance of 10 centimeters. The equal intensity curves (Fig. 6) are those used at the Memorial Hospital, New York City.

The radiation tissue dose is calculated as follows: The outline of the body surface is taken with calipers and drawn on tracing linen. With the pelvimeter, the location and palpable size of the growth and the depth and direction of the uterine canal are determined and entered on the transverse and longitudinal sections. The equal intensity curves are drawn in by using the patterns, or, if the radium capsule lies in a horizontal plane, then the equal intensity curves are entered with a compass, the radii being taken

from the patterns. Point *a* is at the posterior bladder wall, or 2.5 cm. anterior from the radium capsule. Point *b* is at the lateral vaginal fornix and is about 1.5 cm. from the radium capsule. Point *c* is at the anterior rectal wall, *i.e.*, about 3 cm. posterior from the radium capsule. Point *d* is at the lateral bony pelvis, usually about 5.5 cm. lateral from the radium capsule. Points *a*, *b*, and *c* are pushed away from the radium capsule by firmly packing the vaginal canal, and by keeping the bladder and rectum empty during the treatment. The intensities attained at these points are shown in the tabulation on the following page.

The values are expressed in erythema doses. One E.D., according to Martin and Quimby (3), is that dose which in 80 per cent of the cases treated produces a faint reddening or bronzing of the skin in from 10 to 20 days and in the other 20 per cent produces no visible effect. One and one-half E.D. of X-rays given with the factors described equal 900 r without back scattering according to our measurements with a standardized electrometer.

Therefore, using similar calculations, it may be stated that in a patient with a pelvis having an anteroposterior diameter of 20 cm. the highest combined radiation dose is:

- (1) At isodose 20, which is 3 cm. distant from the radium capsule, the tissue dose will be from 3.75 to 4 erythema doses.
- (2) At isodose 10, which is about 5 cm. distant from the radium capsule, the tissue dose will be from 2.75 to 3 erythema doses.
- (3) At isodose 5, which is about 5.5 cm. distant, the tissue dose will be from 2.25 to 2.5 erythema doses.

Should the tumors react to the lethal doses given *supra*, it follows that highly mature and radiation-resistant growths (the prickle-cell cancers) may be successfully treated if they do not extend more than 3 cm. beyond the radium capsule, while the

INTENSITIES IN TRANSVERSE SECTION (FIG. 4)

Radiation source	Posterior bladder wall at <i>a</i>	Lateral vaginal fornix at <i>b</i>	Anterior rectal wall at <i>c</i>	Regional lymph nodes at <i>d</i>
Radium capsule	1.0	2.5	2.0	0.5
Radium cannon	0.36	0.36	0.45	0.36
X-rays	1.5	1.44	1.44	1.44
Total	2.86	4.30	3.89	2.30

INTENSITIES IN LONGITUDINAL SECTION (FIG. 3)

Radium capsule	1.0		2.0	0.5
Radium cannon	0.36		0.36	0.36
X-rays	1.45		1.36	1.5
Total	2.81		3.71	2.36

unripe and radiation-sensitive growths (usually round-cell and spindle-cell cancers), may be arrested in the majority of cases even if they extend to the bony periphery of the pelvis which is 6 to 6.5 cm. distant from the radium capsule.

Carcinoma of the Uterine Body

The difficulties of a homogeneous dispersion of radiation in uterine corpus carcinomas are great if the ordinary tandem applicator employed in cervical carcinomas is used in body cancers. The uterine cavity forms a triangle, the apex being at the internal uterine os, and the base being formed by the fundal wall. The latter from one tubal uterine os to the opposite one measures as a rule 3 centimeters. The loss of intensity at a distance of 3 cm. is about 66 per cent. It is, therefore, self-evident that another solution for homogeneous dispersion of the rays must be found. A Y-shaped radium filter has been constructed (Fig. 7) on the principles of an obstetrical forceps. One blade is inserted first, then the other blade, and the blades then locked. Each arm may carry two tubes of radium, each of 25 milligrams of element. The distribution of

the equal intensity curves is seen in Figure 7. Applications of three séances at 8-day intervals with 150 mg. radium element of 15 hours each will give a 100 per cent E.D. at isodose 20; hence a 200 per cent E.D. is attained at isodose 40. The isodoses 40 from the right and left filter arms enclose the entire uterine body, hence the periphery of the uterus receives 4 erythema doses. One centimeter lateral from the uterine wall the intensity is 3 erythema doses. The vaginal portion of the cervix at the fornices receives about 3 erythema doses. Hence the distribution of the radium intensities with the Y-applicator seems to be very homogeneous and ideal for carcinoma of the uterine body localized within the boundaries of the organ.

Carcinoma of the Ovaries

The difficulties of radiation therapy in ovarian carcinomas are almost insurmountable, due (1) to the large size of such growths; (2) to the early invasion of the peritoneum, with generalized carcinomatosis and ascites, and (3) to the high histological malignancy index which is almost invariably present in ovarian cancers. Radiation ther-

apy, nevertheless, may be carried out according to the technic described for cervical carcinomas. On account of the impossibility of homogeneous distribution of the rays throughout the tumor area, results are cor-

In cancers of the ovaries, permanent results cannot be obtained without resort to surgical intervention. The clearly localized early growths, usually bilateral, should be totally removed and treated with radium in-

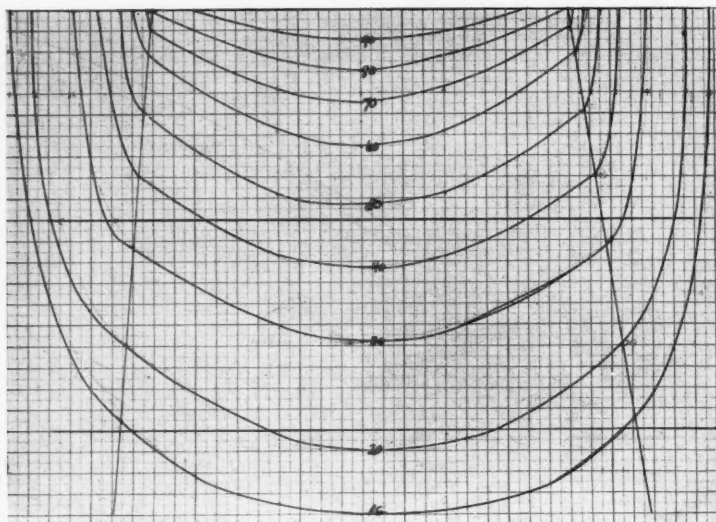


Fig. 5. Equal intensity curves measured in water of short wave roentgen rays produced with factors given in text.

respondingly poor. The small sized, early cancer will respond favorably to radiation treatment. In our series only two cases survived a five-year period. Both of these had cancers limited to the pelvis. However, arrest of the growth for from two to four years is frequently attained with radiation therapy.

Should peritoneal or omental invasion be present, then the port of entrance should include the entire abdomen. Large doses of X-rays cannot be borne well by such patients and it may be advisable to apply from 50 to 75 ma.-min. daily until the full dose of 800 r has been attained with the factors given in the treatment for cervical cancers.

Ascitic fluid should be totally withdrawn before the beginning of treatment. Lymphangioplasty has been a great help in a number of our cases.

tra-uterine and distance radium and short wave X-ray methods. If the case is inoperable, then radiation therapy is indicated. Perhaps the Y-shaped applicator will improve the results of radiation therapy. Should the tumors have shrunk and become movable after radiation, then laparotomy should be done to remove them.

Carcinoma of the Rectum

In rectal carcinomas, the methods of treatment must be adjusted to the location of the growth. The carcinoma is infraperitoneal if confined to the anal portion or the ampulla. It is intraperitoneal if located at the recto-sigmoidal juncture. The clinical extent of the growth permits of a grouping.

Group 1. Cases which are clearly confined to the mucosa.

Group 2. Cases which have infiltrated the muscular layer.

Group 3. Cases which have involved the perirectal tissues.

Group 4. Cases which are fixed or have

tomy, if sterilization of the canal cannot be accomplished or when stricture is present.

Interstitial radiation forms the best treatment of these carcinomas. It is advisable to insert 1 mc. of radon in gold seeds for each

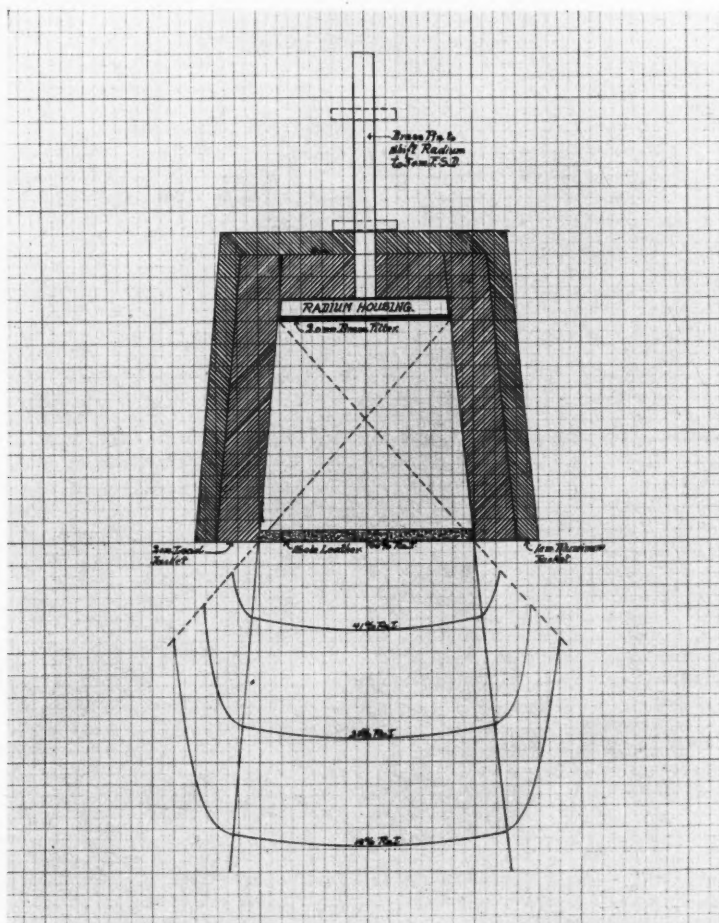


Fig. 6. The radium cannon with the equal intensity curves.

involved the prostate or bladder in the male, and the vagina or uterus in the female.

It is of greatest importance to render the local condition aseptic before radiation is given. This may be accomplished by the internal administration of salol and urotropine, a proper diet which leaves little residue, colonic flushings, and finally colos-

cubic centimeter to be treated. To assure complete destruction, a surface application of radium and X-rays should be made as described in the technic for cervical cancers. The tumor should be measured and sketched on a transverse and longitudinal section so the treatment may be mapped out in a correct manner.

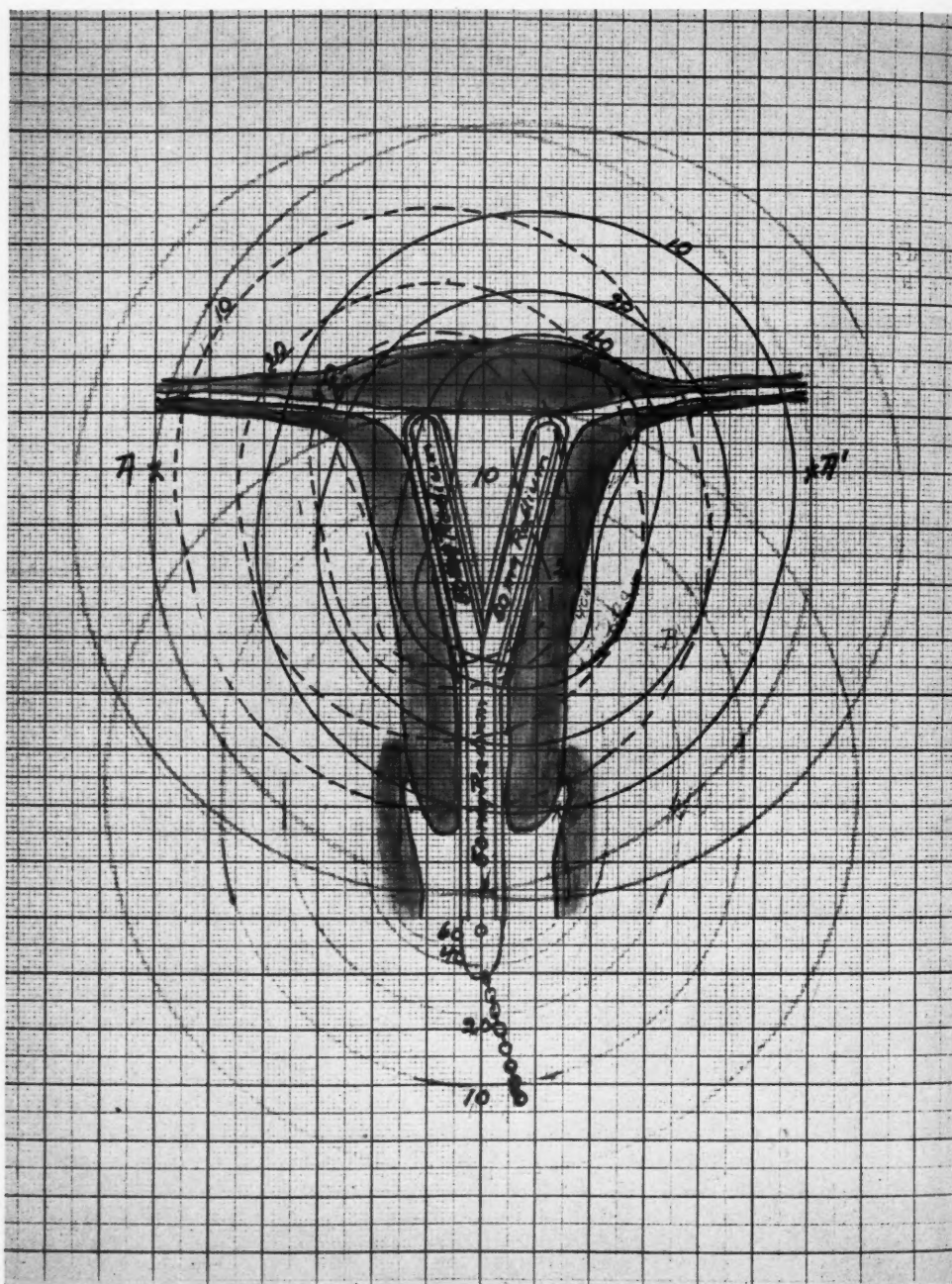


Fig. 7. Schmitz' Y-shaped radium filter for the treatment of carcinomas of the uterine body.

In patients with an annular growth, colostomy is unavoidable, and, in the suprapubic variety, it is an essential step of the treatment. The operation is then one of

access since the gold radon implants can be inserted from above through the laparotomy incision.

Carcinoma of the Urinary Bladder

Malignant tumors of the urinary bladder appear to occupy a unique position in the field of radiation therapy. Quite a number of carcinoma vesicae will totally disappear without leaving a trace behind after an application of from 1.3 to 1.5 E.D. of short wave X-rays (12). Such favorable results probably are due to the histological structure of the bladder mucosa, which consists of an outer layer of round or transitional cell epithelium and a basal layer of spindle-cell epithelium. The mature and highly differentiated spinous cell is never seen, according to Notkin (9), Eggeling (8), and Gaebler (10). Carcinomas of the bladder are, therefore, predominantly composed of either transitional or basal cells or a mixture of both. Metaplasias into squamous-cell cancers are seen but they are rare. Transitional and spindle-celled carcinomas are associated with immaturity and undifferentiation of the cells, cytoplasm, and nucleus. They are highly radiosensitive. Such cancers are either exophytic and seen as papillary growths, or endophytic and represented by the indurating growths.

Bladder carcinomas are also grouped according to their clinical extent. Group 1 means a clearly localized carcinoma. Vaginal or rectal palpation is negative. Cystoscopic examination reveals a localization of the growth in the mucosa. Distensibility and, therefore, mobility and tolerance are normal. In Group 2 are placed the cases in which the carcinoma can be palpated due to invasion and thickening of the muscular layers. Cystoscopy reveals a tumor surrounded by an area of reddening and bullous edema. If the carcinoma is sessile, then ulceration has occurred in the center. The capacity of the bladder is normal, but dis-

tensibility and tolerance are impeded. Group 3 cases comprise growths that have broken through the bladder wall and invaded the perivesical tissues. Mobility is clearly impeded due to loss of normal elasticity of the invaded tissues. Distensibility is markedly lessened, tolerance more so. Cystoscopic examination reveals ulceration, necrosis, cystitis. The bullous edema and the deeply reddish infiltration involve more or less the entire surface of the mucosa. In Group 4 are placed the tumors with stone-hard consistency and absolute fixation. Distensibility of the bladder is lost, and tolerance. Cystoscopic examination reveals a total invasion of the bladder, partially with cancer and partially with the complicating infection. Such a grouping is necessary as the prognosis and indications of treatment are dependent on it.

Group 4 cases are terminal and always have a fatal prognosis. Hence such patients should be rendered comfortable by symptomatic treatment. Group 1, 2, and 3 cases are treated with short wave X-rays. The tumors that do not completely react to X-rays are subjected to interstitial radiation with radon gold implants and followed with distance radiation with the radium cannon.

CONCLUSIONS

The technic of irradiation of pelvic cancers as employed and developed by the author has been described.

1. The methods of calculating the dose have been discussed and the accessories to carry out the determination of the tissue dose have been illustrated and described.

2. The methods of application of rays are: (1) cavitory; (2) interstitial, and (3) distant. The sources of radiations are radium, radon, and X-rays.

3. The lethal tissue dose has been tentatively placed at about from 2 to 2.5 E.D. for highly immature cancers usually with a predominance of round and spindle epithelial

cells or adenocarcinoma and solid adenocarcinoma. The lethal tissue dose has been set at from 4 to 5 E.D. for highly mature cancers usually associated with spinous epithelial cell cancers or adenoma malignum and everting papillary adenocarcinoma.

4. The determination of the clinical extent and the grouping of cancers has been given. Such grouping is important for the prognosis of treatment, the selection of the indicated method of treatment, and especially for the application of radiation.

5. Careful calculations of the tissue dose and constant follow-up to acquaint oneself with the end-results attained in each case are necessary to determine the efficacy of the therapeutic methods employed.

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DISCUSSION

DR. H. J. ULLMANN (Santa Barbara, California): My discussion will be largely the asking of questions, for because of my inexperience and limited clinical facilities, I am unable to add anything.

The squamous type of carcinoma, as Dr. Schmitz has said, is more radioresistant than the adenoma, but in this type there is another difficulty in treatment that has not been spoken of. Quite a number of my patients with a squamous carcinoma are apt to have an atresia of the cervix, and I have great difficulty in getting sufficient dilatation to admit the radium, and sometimes I cannot get even a probe into the canal. In these cases, we must consider some means of increasing the effect of external radiation, and I include, by external radiation, radium applications in the vagina, placed against the cervix. I think that Dr. Wood and Dr. Withers, as well as I, believe that in some of these cases, at least, the addition of lead increases the sensitivity of these tumors to radiation.

Dr. Schmitz has spoken of dividing the doses over a period of time, and I would like to have him discuss that a little further, for the question of interval of dosage is tremendously important. He spoke of applications at eight- or fourteen-day intervals. I have noticed a considerable difference of results, in some cases at least, between doses given at eight days, fourteen days, and three weeks.

I would also like to know why two erythema doses can be put on to the skin when one-half is with the X-ray and one-half with radium. I understood in discussions earlier to-day that the increased effect could be in the neighborhood of only 40 to 50 per cent instead of 100 per cent.

The caliper arrangement for mapping out the surface of the body is excellent. I have not used it on the body, but I have used it about the neck. The Memorial Hospital ap-

paratus is the one that I have in use. For many years, I have used for the body a strip of lead about an eighth of an inch, or less, thick, which will mold about the body perfectly, and then may be lifted and transferred directly to the paper. Later I substituted a draftsman's flexible rule which will bend in one direction only. After this has been transferred to the paper, I use the ordinary caliper anteriorly and posteriorly to see if there has been an error in transferring the flexible rule from the body to the paper. I believe the flexible rule would be rather more rapid than the other method, but I have not tried the caliper on the body.

The question of radiation sickness is very important in many of these pelvic cases, because they are frequently advanced, and for that reason must be given divided doses, which again brings up the importance of the intervals between radiations. I would like Dr. Schmitz to elaborate on that: both on the intervals and the period of time in which the entire dose is given, whether it is given in one week, two weeks, or three weeks; whether he uses a so-called saturation table or loss of effect per day table, or something of that sort, in order to regulate the dose. I have been, for a number of years, assuming a 7 per cent per day loss. It makes no difference if one uses 6, 7, or 8 per cent, whichever is correct, if a definite rate of loss is assumed in calculating. If the patient is upset by a treatment, a day or two days may be skipped, and then, of course, the total dose in r is increased tremendously, because that loss is taken into consideration.

DR. SANFORD WITHERS (Denver, Colo.): What Dr. Ullmann has said about the difficulty of finding the cervical canal and applying radium to it makes me wish to tell you of my routine method. In those cases in which, before treatment is begun, it is impossible to find the cervical canal with a probe, I apply 1 to 2 gr.-hours against the cervix, filtered through 2 mm. of lead at a distance of 1 centimeter. Following this, I proceed to give X-ray treatment over a period of from 7 to 14 days. This procedure

causes the cervical mass to melt away and there is a marked diminution in the secondary infection and the cervical canal is usually found. If it is still impossible to find the cervix and place the tube in the uterine canal, then I implant the cervix and the base of the broad ligaments with radium needles and wait a few days longer, again attempting to find and dilate the internal os. If you will follow some such routine, I do not believe that you will miss the cervical canal in more than one case out of a hundred treated. You will also find that the debilitated patient can withstand this treatment better than the large single doses.

I wish to make another suggestion applicable to the treatment of the obese patient with large pelvic measurements, and patients with perineal relaxation and more or less prolapse of the uterus. My suggestion is to use a perineal portal of X-ray to increase the depth dose. I commonly use a 12 by 12 cm. portal and have frequently used a 15 by 15 cm. portal centered so that the axis of the beam passes through the center of the pelvis. In many obese patients, the distance from the perineum to the cervix is only from 6 to 8 cm. (sitting position), whereas the distance from the anterior or posterior skin is from 10 to 12 centimeters. By the use of the perineal portal, one can increase the depth dose then from 30 to 50 per cent.

DR. FRANCIS CARTER WOOD (New York City): Dr. Ullmann has asked me to explain that he was not speaking of the large adenocarcinoma of the cervix, but the small squamous-cell type of growth in which the cervix was contracted and it was impossible to get the instruments into it.

DR. HENRY SCHMITZ (closing): The sequence of the course of treatment is as follows: Assume the patient arrives at the hospital on Sunday; she is told to be there 24 hours before for general, blood, and urine examinations, etc. This also enables us to record pulse and temperature for at least 24 hours. Thus we gain an idea as to whether or not we may be dealing with an infection

added to the carcinoma. If so, we immediately take a sedimentation test of the red blood corpuscles and at the same time make a culture from the cervical smear on the patient's own blood serum. Should growth occur within from four to six hours, then infection is present. Should the culture be negative, then it may be assumed that the patient does not harbor pathogenic bacteria. In the latter instance, the radiation treatment is ordered.

The next morning the patient is placed under gas and another careful examination of the pelvic organs is made to determine the extent of the disease. If the disease extends anteriorly, a cystoscopic examination is made; if it extends posteriorly, a proctoscopic examination should be done. Invasion of adjacent organs contra-indicates radium radiation. A biopsy is taken and the patient referred to the X-ray therapy department. Otherwise dilatation of the cervical canal is done and the radium capsule placed in the canal and uterine cavity for 30 hours. The capsules contain 50 mg. of radium element and are filtered with an equivalent of 2 mm. brass. The capsule is

removed, to be reinserted every seventh day for the same period of time. The radium cannon is applied 10 hours each day, if possible. Wednesday, Thursday, Friday, and Saturday the patient receives one-fifth of an X-ray dose alternately, to an anterior and a posterior field. On Monday morning, the radium capsule is again inserted; the radium cannon is working 10 hours daily between times, and on Wednesday, Thursday, Friday, and Saturday another one-fifth dose of X-rays is given, 2 to the anterior and 2 to the posterior field. On Monday the fourth application of radium is made and on Wednesday and Thursday the last X-rays are given; so that within 18 days the combined treatment has been applied.

The treatment is never repeated. The patient is told to use Dodd's lotion to the skin area twice daily. We usually interdict the use of douches of any kind, but advise the taking of tub baths. The patient in the second or third week may begin to complain about frequent or burning urination, and in a few instances the patient may have a radiation proctitis but such is self-limited.

THE USE OF SODIUM AMYTAL AS AN ANESTHETIC AGENT IN CANCER THERAPY

By GEORGE L. SHEEHAN, M.D., Anesthetist, State Institute for the Study of Malignant Disease, BUFFALO, N. Y., Burton T. Simpson, M.D., Director

IN A presentation of the use of sodium amytal intravenously as an anesthetic agent, a review of the history as well as the method of preparation for use may be of interest.

Sodium amytal was evolved out of a study of the barbituric acid derivatives which has been carried on since 1903, when veronal was found to be a valuable hypnotic. Chemically, sodium amytal is sodium iso-amyl-ethyl barbiturate. The distinction of finding these drugs of value in the induction of anesthesia belongs to the researches of many physicians.

L. G. Zerfas, J. T. C. McCallum (1) and their associates in the Indianapolis City Hospital were among the first to use sodium amytal intravenously on human patients. Brown (2) makes a reference to the successful use in the Mayo Clinic of sodium amytal intravenously as an induction anesthetic in over 1,000 cases. There are many others who have used this drug intravenously, among whom are Heyd (3), Mason and Baker (4), Moore (5), Lundy (6), Isenberger (7), and many others.

Sodium amytal is a white crystalline powder, put up in ampules each containing 1 gm. of the drug. With each ampule is a companion ampule of 10 c.c. of sterile water, triple distilled. Not longer than fifteen minutes before injection the ampule of sodium amytal is prepared by dissolving the powder in the 10 c.c. of sterile water, making a 10 per cent solution. Several minutes must elapse for the complete solution of the crystals to take place and also for the solution to be free from air bubbles.

The dosage and rate of injection of sodium amytal are approximately 0.06 gm. of the drug for every ten pounds of body

weight of the patient, injected at the rate of not more than 1 c.c. of the 10 per cent solution per minute. This total dosage varies according to the individual's nervous make-up.

While the drug is being injected, the patient suffers no apprehension or nervousness. Usually the first subjective symptoms noticed are fatigue, languor, and numbness of the extremities. In a very few cases there is an excitement stage. If the patient is forced to talk, dysphasia will be noticed. The patient may then yawn and go immediately into a deep sleep from which he cannot be aroused by ordinary stimuli. This usually occurs when 0.4 to 0.6 gm. of the drug has been injected.

Following the above stages, or coincident with the last-named stage of unconsciousness, the blood pressure begins to drop from 20 to 60 points systolic, and 10 to 30 points in diastolic pressure, the respirations becoming slower and more shallow. Following these comes a stage of relaxation of throat and tongue musculature, and, in some cases, slight cyanosis and feeble pulse at the wrists.

Post-operative care in the cases cited consisted in frequent changes in the patient's position in bed to prevent stasis in the lungs. Patients as a rule were placed face down, or on one side, to prevent swallowing of their tongues. A few cases which showed excitement on reacting were given a hypodermic of morphine sulphate, 0.025 gm., which seemed in each case to quiet them fully. It was also noticed that, following the operation, the patients invariably had a night of profound slumber.

A list of cases in which sodium amytal was used is shown in the following chart:

Initial, Case No., Weight	Diagnosis	Operation	Total amount of drug used	Hypnosis occurred	Blood pres- sure before injection	Blood pres- sure after injection	Reacted in	Remarks
M. B. 13441 150 pounds	Ca. Cervix	Implantation radium seeds and tubes	.7 gm.	.5 gm.	120/80	112/76	4 hrs. 40 min.	No post-operative complications
N. C. 13480 205 pounds	Ca. Cervix	Implantation radium seeds and tubes	.7 gm.	.5 gm.	140/70	130/68	2 hrs.	Supplemented by N ₂ O
M. B. 13482 150 pounds	Ca. Cervix	Implantation radium seeds and tubes	1 gm.	.8 gm.	120/70	100/65	2 hrs.	Completely relaxed
H. B. 12963 132 pounds	Ca. Cervix	Implantation radium seeds and tubes	.6 gm.	.5 gm.	110/70	.....	.....	See Footnote 1
E. C. 13527 140 pounds	Ca. Cervix	Implantation radium seeds and tubes	.85 gm.	.4 gm.	150/80	100/65	2 hrs. 10 min.	Completely relaxed
M. C. 12651 190 pounds	Ca. Cervix	Implantation radium seeds and tubes	1 gm.	Became drowsy only	140/95	.....	1 hr.	Supplemented by N ₂ O
H. K. 13544 210 pounds	Ca. Cervix	Implantation radium seeds and tubes	1 gm.	.6 gm.	130/65 lt. ²	160/100 rt. ²	3 hrs.	Completely relaxed, moved only once
A. C. 13568 197 pounds	Ca. Cervix	Implantation radium seeds and tubes	.8 gm.	.4 gm.	160/100	80/60	7 hrs. 50 min.	No movements
S. M. 12788 130 pounds	Ca. Cervix	Implantation radium seeds and tubes	1 gm.	.6 gm.	100/60	70/50	2 hrs.	All reflexes absent, did not move
B. M. 1892 146 pounds	Ca. Cervix	Implantation radium seeds and tubes	1 gm.	.6 gm.	170/80	94/40	1 hr. 40 min.	All reflexes absent, did not move
F. D. 13607 145 pounds	Ca. Cervix	Implantation radium seeds and tubes	.9 gm.	.5 gm.	130/80	90/70	1 hr. 45 min.	Supplemented with N ₂ O for one minute when cervix was dilated
M. S. 13621 143 pounds	Ca. Cervix	Implantation radium seeds and tubes	1 gm.	.6 gm.	180/100	90/160	55 min.	No movements
S. P. 12053 161 pounds	Ca. Cervix	Implantation radium seeds and tubes	.9 gm.	.5 gm.	148/70	100/64	1 hr. 55 min.	Supplemented with N ₂ O at end of operation. Pharyngeal reflex not entirely absent

¹After 0.1 gm., patient became excited and cried. After 0.4 gm. more, she went to sleep. After 0.6 gm., she stopped breathing, lips became cyanotic, pulse irregular. Oxygen forced into lungs, then artificial respiration resorted to. Epinephrine injected. The patient awoke, and when cervix was dilated, became partly conscious. It was, therefore, necessary to resort to gas anesthesia to keep her quiet. There was apparently collapse of the respiratory system, which brought about a condition of shock, causing all blood to go to the splanchnic area, resulting in anemia of the brain as the patient seemed to pick up after the injection of the epinephrine.

²Blood pressure reading different in each arm, and therefore, cannot be used as an indication of sodium amylal effect but must be due to some cardiac condition.

A. G. 13636 179 pounds	Ca. Cervix	Curetteage	1 gm.	.6 gm.	180/92	120/72	30 min.	Moved slightly
L. G. 13638 135 pounds	Ca. Cervix	Implantation radium seeds and tubes	.9 gm.	.5 gm.	145/80	80/60	1 hr. 10 min.	No movement
I. S. 13641 130 pounds	Ca. Cervix	Implantation radium seeds and tubes	1 gm.	.6 gm.	120/72	78/64	3 hrs. 55 min.	No movement
M. T. 10974 155 pounds	Ca. Cervix	Implantation radium seeds and tubes	.8 gm.	.4 gm.	200/110	110/80	4 hrs.	Complete relaxation
J. D. 13699 110 pounds	Ca. Cervix	Implantation radium seeds and tubes	1 gm.	.6 gm.	140/78	100/68	4 hrs. 45 min.	Moved slightly
K. H. 13712 142 pounds	Ca. Cervix	Implantation radium seeds and tubes	.7 gm.	.4 gm.	120/80	80/60	1 hr. 10 min.	No movements
M. G. 13711 178 pounds	Ca. Cervix	Implantation radium seeds and tubes	1 gm.	.6 gm.	112/80	96/82	1 hr. 10 min.	No movements
M. K. 13738 135 pounds	Ca. Cervix	Implantation radium seeds and tubes	.9 gm.	.5 gm.	130/70	120/80	5 hrs. 30 min.	Complete relaxation, all reflexes absent
K. D. 12842 130 pounds	Ca. Cervix	Implantation radium seeds and tubes	.7 gm.	.4 gm.	110/70	100/80	1 hr. 55 min.	All reflexes absent
F. C. 13956 170 pounds	Ca. Cervix	Implantation radium seeds and tubes	1 gm.	.6 gm.	118/76	104/80	3 hrs. 45 min.	See Footnote 3
R. K. 13477 145 pounds	Ca. Rectum	Implantation radium seeds, section taken	.8 gm.	Drowsy only	125/75	.....	1 hr.	Supplemented with N ₂ O
H. H. 13483	Ca. Rectum	Implantation radium seeds, section taken	.7 gm.	.5 gm.	150/75	102/70	1 hr.	Reflexes absent. Pharyngeal reflex returned after continued stimulation in rectum.
M. A. 13490 117 pounds	Ca. Rectum	Implantation radium seeds, section taken	.8 gm.	.3 gm.	140/90	117/70	3 hrs. 25 min.	No movement, pharyngeal reflexes entirely absent
P. B. 11595 86 pounds	Ca. Rectum	Implantation radium seeds, section taken	.4 gm.	.2 gm.	110/80	94/72	5 hrs. 45 min.	Pharyngeal reflex completely lost

³Apparently went to sleep, but when cervix was dilated she started to move on the table. Supplemented with N₂O for about 5 minutes, after which the procedure was done without N₂O.

Initial, Case No., Weight	Diagnosis	Operation	Total amount of drug used	Hypnosis before occurred	Blood pres- sure before injection	Blood pres- sure after injection	Reacted in	Remarks
M. P. 13536 154 pounds	Ca. Rectum	Implantation radium seeds, section taken	1 gm.	.7 gm.	160/100	100/67	3 hrs. 3 min.	Pharyngeal reflex markedly dulled
H. B. 13553 158 pounds	Ca. Rectum	Implantation radium seeds, section taken	1 gm.	.6 gm.	122/80	70/20	.....	History of being sensitive to pain. Moved all over the table when the rectum was dilated.
F. S. 13953 185 pounds	Ca. Rectum	Implantation radium seeds, section taken	1 gm.	.6 gm.	162/90	100/80	4 hrs. 40 min.	See Footnote 4
N. D. 13794 190 pounds	Ca. Rectum	Implantation radium seeds, section taken	1 gm.	.6 gm.	140/00	56/34	4 hrs.	All reflexes absent, breathing shallow
D. F. 13087 165 pounds	Ca. Rectum	Implantation radium seeds, section taken	1 gm.	.6 gm.	180/100	100/70	.....	Moved slightly
G. H. 13437 122 pounds	Ca. Breast	Tumor removed from breast	.7 gm.	.4 gm.	140/100	104/70	6 hrs.	See Footnote 5
G. H. 13437 122 pounds	Ca. Breast	Simple amputation of breast	.8 gm.	.4 gm.	142/80	60/40	.....	No movement, reflexes absent, respiration shallow
H. J. 13314 125 pounds	Ca. Breast	Seeds planted in breast	.6 gm.	.4 gm.	160/90	145/75	2 hrs.	When seeds were implanted, the patient moved several times; had to be restrained by nurse
K. W. 13456 180 pounds	Ca. Bladder	Punched out base of bladder	.7 gm.	.4 gm.	170/90	120/60	2 hrs. 15 min.	Not entirely under effect of drug; complained slightly
H. S. 1930 205 pounds	Leiomyoma, broad ligament	Laparotomy, leiomyoma removed from broad ligament	.4 gm.	.4 gm.	.....	.....	2 hrs.	See Footnote 6
C. G. 13689 104 pounds	Ca. Vulva	Coagulation vulva	.5 gm.	.2 gm.	140/70	120/64	3 hrs. 35 min.	Supplemented with N ₂ O
F. H. 13440 180 pounds	Ca. Antrum	Antrum curetted and radium seeds implanted	.6 gm.	.3 gm.	160/100	160/100	About 4 hrs.	See Footnote 7
L. M. 13552 115 pounds	Ca. Antrum	Implantation of radium seeds	.7 gm.	.4 gm.	170/90	84/20	12 hrs.	No movements, reflexes absent

^aWhen rectum was first dilated, the patient moved his head from side to side and became somewhat rigid, then relaxed in from 2 to 3 minutes.

^bMoved head slightly when skin was incised. Patellar reflexes just barely elicited after operation.

^cSodium amytal given in preparation for gas anesthesia and patient was deeply anesthetized.

^dFour or five times during operation moved either arm and either leg slowly. No depression of pain.

E. G. 11493 85 pounds	Ca. Antrum	Antrum curetted and radium seeds implanted	.6 gm.	.4 gm.	120/90	Unable to get blood pressure but a few heart beats were heard at 50	Complete relaxation
A. T. 14186 198 pounds	Ca. Antrum	Implantation of radium seeds, section taken	1 gm.	.6 gm.	160/120	140/100	Cough reflex excited when blood dripped down pharynx
A. B. 1937 130 pounds	Ca. Tongue	Implantation of radium seeds	.5 gm.	.3 gm.	180/80	90/40	No movement, pharyngeal re- flexes absent
W. G. 13972 130 pounds	Ca. Tongue	Implantation of radium seeds, section taken	1 gm.	.5 gm. excitement stage, sleep after 1 gm.	142/88	180/120	Moved several times, pharyngeal reflexes present
J. K. 13970 145 pounds	Ca. Tonsil	Implantation of radium seeds, section taken	1 gm.	.6 gm.	90/60	80/50	Some struggling was necessary to restrain him on table
J. I. 13550 128 pounds	Ca. Orbit	Implantation of radium seeds, section taken	1 gm.	.6 gm.	150/82	90/50	No movements
P. W. 10235 145 pounds	Ca. Ear	Coagulation of ear by electric cautery	.65 gm.	.35 gm.	134/72	86/60	Supplemented by N ₂ O
I. R. 13166 135 pounds	Ca. Scalp	Tumor removed by electric cautery	.5 gm.	.3 gm.	Not taken	80/50	Some movement of body, espe- cially when cautery was going through skin
A. H. 12901 145 pounds	Ca. Scalp	Excision of tumor in scalp	.7 gm.	.4 gm.	138/76	118/70	Moved several times, especially when skin was incised
L. R. 10864 100 pounds	Benign stricture of esophagus	Esophagoscopy	.5 gm.	.4 gm.	.....	.....	Slow movement of both arms and legs but no apparent con- sciousness or pain
C. B. 13436 142 pounds	Ca. Esoph- agus	Esophagoscopy	.5 gm.	....	.....	.....	See Footnote 8
C. B. 13436 142 pounds	Ca. Esoph- agus	Esophagoscopy	1.6 gm.	1 gm.	160/90	100/64 at end of injection 120/72 at end of operation	See Footnote 9
M. D. 13534 138 pounds	Papilloma Esophagus	Esophagoscopy	1 gm.	.6 gm.	130/78	100/65	Not completely relaxed until 15 minutes after injection

*Apparently asleep, but when the tube was passed became partly conscious and moved all over the table so that it was not possible to pass the tube down the esophagus.

*Became cyanotic, pulse irregular. Necessary to administer oxygen, inject caffeine of benzoate, and epinephrine.

†Four or five times during operation moved either arm and either leg slowly. No expression of pain.

‡Nervousness, no recollection either of going to or coming from operating room.

CONCLUSIONS

1. No drug rash was observed in any of the cases and there were no post-operative nausea and vomiting.

2. Febrile and alcoholic patients take the maximum dosage. The more rapid the fall of blood pressure during the injection, the better is the hypnosis or analgesia secured.

3. If hypnosis appears when from 0.3 to 0.5 gm. of sodium amytal has been injected, usually a fair degree of anesthesia is produced by a total dosage of one gram. When necessary that 0.7 to 0.9 gm. of sodium amytal be injected before hypnosis appears, 1 gr. of sodium amytal will then produce a poor degree of anesthesia, and to produce relaxation, more of the drug must be injected or supplementary inhalation of nitrous oxide resorted to.

4. The drug is of great value in highly nervous patients for it can be injected intravenously in the room before the patient is sent to the clinic, and there is no recollection of going to or from the operating room.

5. It is of special value in cases of surgery around the head and neck including the antrum, nose, tongue, mouth, and throat carcinoma, or face carcinoma, where inhalation of an anesthetic is difficult and the anesthetic apparatus interferes with the operator. Sodium amytal can be used in these cases (antrum, nose, mouth, tongue, and throat carcinoma) in such dosage as to give

partial anesthesia without the loss of the pharyngeal reflex, thus allowing the patient to cough out the blood which may reach the pharynx.

6. Simple mastectomy can be performed under sodium amytal anesthesia. Sodium amytal intravenous anesthesia was used in 23 cases of carcinoma of the cervix and uterus and was found to be a satisfactory and useful drug. Many of the rectal cases have to be supplemented by nitrous oxide when sodium amytal is given first.

7. Urinalysis before and after the use of sodium amytal showed no gross changes.

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PULMONARY ASBESTOSIS¹

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THE fact that the inhalation of asbestos dust produces an effect upon the lungs was observed many years ago, but the serious results which follow have only more recently been recognized. The pathologic lesions which it produces and its symptomatology have been studied in more detail just recently at the City of London Chest Hospital, by Dr. W. Burton Wood and Dr. S. R. Gloyne. As the result of the study of the radiologic appearances in a series of patients suffering from this disease we have been able to gain some idea of the changes it produces in the lung, which may, I hope, in future be of some value in the further study of this condition and its earlier recognition. This disease was described by H. K. Pancoast and E. P. Pendergrass (12), of Philadelphia, as long ago as 1925, since which time practically no literature on the subject has been published in America, so far as I am able to learn, apart from a recent editorial in the *Journal of the American Medical Association* (1) describing the death of a patient from pulmonary asbestosis. This patient apparently commenced to be exposed to the dust as long as 32 years before death. This would not suggest that the disease was a very serious one from the point of view of shortening the duration of life.

Asbestos, which was known to the ancient world, is a silicate occurring in minerals in combination with iron, magnesium, calcium, or aluminum and is quarried or mined in various parts of the world, including Italy, South Africa, and Canada. Of the asbestos imported into England, 80 per cent comes from Canada, so that it seems unlikely that

you in the United States are dealing with a type of asbestos different from that employed in England. It seems reasonable to suppose, therefore, that an effect should be produced on the lungs similar to that produced in England, providing that the manufacturing processes are carried out in the same way. Unfortunately, I have no knowledge of the processes employed in America. It may be that we are more economical in our country in that we make use of the short asbestos fibers which would otherwise be wasted and they are used for dry cloth weaving. In its natural state asbestos differs from other minerals in that it is fibrous, occurring in long silky strands which are highly resistant to heat, strong acids, and alkalis.

During the manufacturing processes the workers may be exposed to dust containing varying amounts of asbestos. In some of these processes the asbestos content is very high and in others much lower, the higher asbestos content being present in the air of the rooms devoted to the textile branch of the industry. I have no knowledge of the effect on the workers mining the crude material as there are no mines in England.

It has been estimated by Dr. E. Merrywether (2), one of His Majesty's Inspectors of Factories, that at the present time something over two thousand workers in England are exposed to the inhalation of pure asbestos dust, as distinct from a very much larger number of workers who may be exposed to asbestos admixed with other products. In his report, however, it is very striking to notice the preponderance of workers who have been employed in the asbestos factories for a period of four years or less. It seems reasonable to suppose that after some years of such employment the

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workers may become affected by the inhalation of asbestos dust and seek other industries. The fact that they cease to be ex-

posed to the dust does not, however, prevent the disease, when once established, from progressing.

Asbestos is usually broken up into short lengths before importation into England, where it is crushed and disintegrated and sometimes mixed with various substances

for hardening into sheets, tiles, building and insulating materials, or brake linings. Sometimes it is carded, spun, or woven into various products like mats, mattresses, fire-curtains, or used as an inert filling of a heat-resisting character. That the asbestos industry is a growing one is shown by the fact that the importation of asbestos has trebled within the last five years, and it seems likely that the study of the dangers which accom-

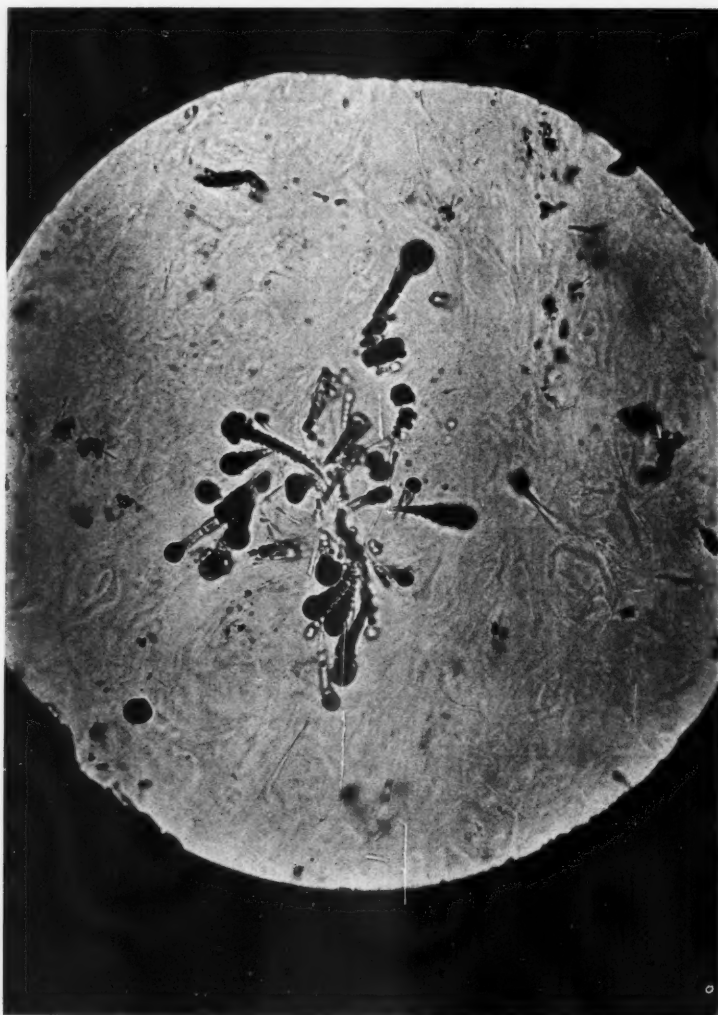


Fig. 1. Photomicrograph of tissue from lung showing asbestosis bodies ($\times 760$).

pany it will become of increasing importance.

When examined microscopically by dark-ground illumination the fiber gives the impression of a sharp, brittle metallic wire broken off at various angles and in different lengths, and, being highly refractile, it has the appearance of the glowing filament of an electric bulb.

The fibers can be found in the nose and mouth and in the skin lesions of the workers. When inhaled into the lung the fibers set up a pneumoconiosis of a characteristic variety.

ETIOLOGY AND PATHOLOGY

The first fatal case of pulmonary asbestosis recorded was that by H. Montague Murray (3), who made a postmortem examination of a case at Charing Cross Hospital in 1900. The next case recorded was by W. E. Cooke (4) and Stuart McDonald (5). In the lungs of this patient they noted the presence of certain curious golden yellow bodies having the appearance of minute crustacean forms.

In 1929 Stewart (6) and Haddow (7) showed that these curious bodies could be found in the juice expressed postmortem from the lungs in cases of pulmonary asbestosis, and that they also could be detected in the sputum. It was these writers who first suggested the name of "asbestosis bodies" for these structures (Fig. 1).

Later in 1929, S. R. Gloyne (8) showed by means of dark-ground illumination that when an asbestos body was dissolved in concentrated sulphuric acid it had a central core consisting of a minute asbestos fiber. He has also demonstrated the presence of foreign body giant cells in the lung sections from a guinea pig, and states that it is important to demonstrate tubercle bacilli in the human lung in the presence of asbestosis before assuming that tuberculosis is present as a complicating factor.

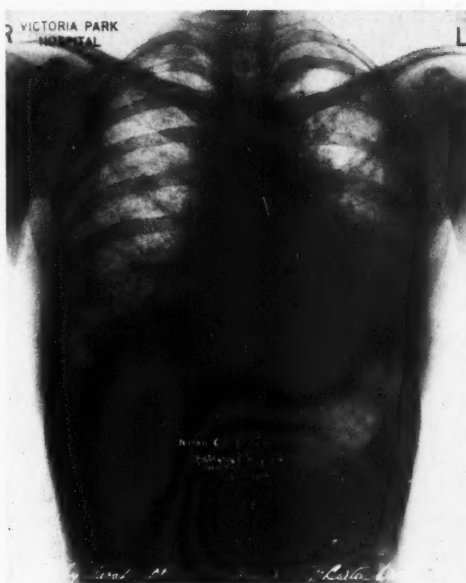


Fig. 2. Roentgenogram of chest of asbestos worker: exposed for nine years: duration of symptoms, three years.

Up to the present we have examined some fifty cases at the City of London Chest Hospital and have six records of postmortem findings.

The *Symptoms and Physical Signs* are described by W. Burton Wood (9) as follows:

The cardinal symptoms are dyspnea and cough; the former is in many cases the earliest symptom noted by the patient, who complains of slight breathlessness on hurrying or going upstairs, or that his chest "feels stuffy." He, therefore, discards the respirator worn hitherto under protest. In the late stage of the disease dyspnea may be extreme, and slight exertion may give rise to labored breathing. Cough is a variable symptom and, though usually present, it may be absent for long periods. It is either dry or accompanied by the expectoration of a little viscid phlegm. The sputum in this, as in other chronic pulmonary diseases, may on occasions be streaked with blood; this

is, however, exceptional. The only frank hemorrhage noted in our series of cases occurred in an asbestos worker who was also

PHYSICAL SIGNS

When the disease is established the skin has an unhealthy leaden hue. Cyanosis may

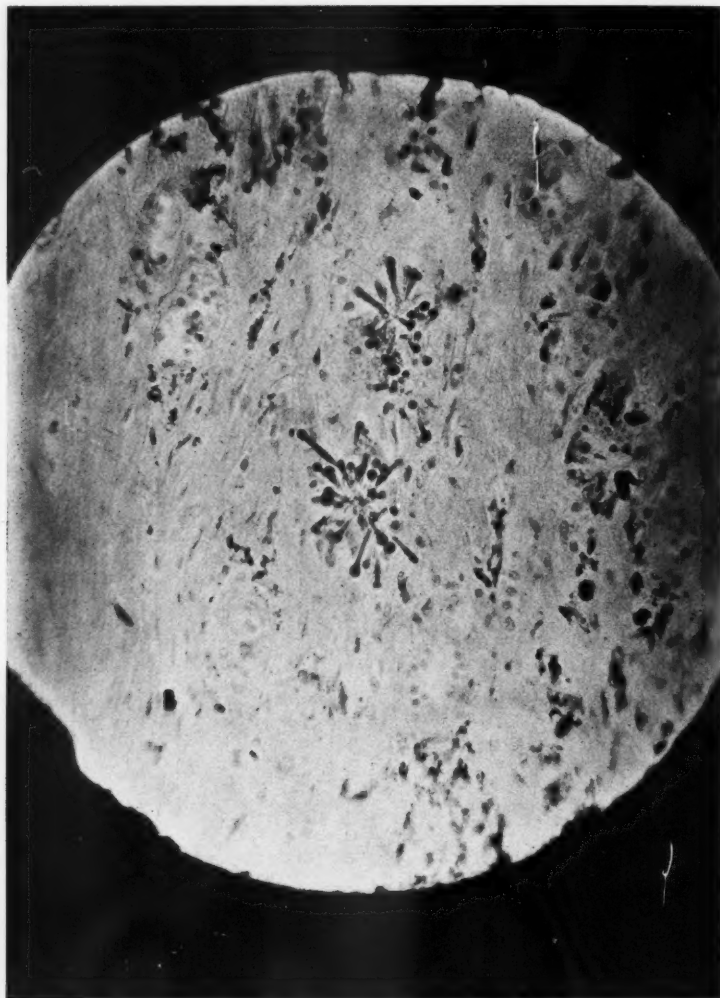


Fig. 3. Photomicrograph of section of lung of case shown in Figure 2.

suffering from adolescent phthisis, with cavitation.

Many patients complain of anorexia, lassitude, pains in the chest, and loss of weight; this latter is a noteworthy feature, for the wasting may be progressive and in the late stages is sometimes extreme.

be absent, slight, or sufficiently evident to cause a dusky complexion. The chest is poorly covered and expansion is defective—it may be reduced to one inch or less. The vital capacity of one of our male patients was only 1,600 cubic centimeters. Clubbing is seldom a marked feature, but a slight

swelling of the skin above the proximal ends of the nails is often apparent. Corns due to the irritation caused by the asbestos fibers in the superficial layers of the skin of the hands are occasionally seen. The skin in other exposed positions, *e.g.*, the legs of girl workers, may be similarly affected.

The physical signs in the lungs are those of pulmonary fibrosis, limited to, or predominant at, the lung bases. The coarse creakings and crepitations usually associated with fibroid change are, however, replaced by fine dry crackles. These may arise in the pulmonary parenchyma or be due to the movement of slightly roughened pleural surfaces. A definite friction rub may be heard over one or the other axillary base. As the fibrosis is bilateral there is seldom any appreciable cardiac displacement.

CLINICAL DIAGNOSIS

When the patient's occupation is known diagnosis should seldom be difficult except in the early stage of the disease. The history of cough and dyspnea, the signs of pulmonary fibrosis and the situation and quality of the adventitious sounds, the radiologic appearances, and the presence of asbestos bodies in the sputum combine to form a distinctive clinical picture. The presence of asbestos bodies in the sputum does not necessarily mean that the patient is suffering from pulmonary asbestosis, but merely that he has been subjected to the inhalation of asbestos dust. The previous occupation of the patient may be of importance in excluding the possibility of fibrosis from other causes.

PROGNOSIS

It is too early in the study of this disease to say very much on this subject, but once the asbestos bodies appear in the sputum the course of the disease would appear to be progressively downwards, nor does the

cessation of exposure to the dust avail to check its spread. Symptomatic treatment is disappointing as we have no means of relieving the dyspnea which is the patient's chief complaint. Prophylaxis is all-important and the only hope for the asbestos worker lies in the adoption of the proper means of protection against the risk attendant on the inhalation of the fibers.

POSTMORTEM FINDINGS

The findings in one case (N. C., female, aged 34, Fig. 2) are described by Dr. Page (10). The body was emaciated. The pleuræ were uniformly thickened to a slight extent on both sides; some recent plastic pleurisy was present. The lungs showed a diffuse fibrosis and were contracted—the left lung more than the right. On section, the trabeculæ stood out rather prominently, forming a fibrous network, especially in the right upper lobe. The bronchi were only slightly dilated. The lungs were congested and in patches were bronchopneumonic. Microscopically the fibrosis became more readily apparent in less affected areas; it was more prominent around the blood vessels and less so in the alveolar walls, while in some sections little was seen but scar tissue, with blood vessels and numerous elastic fibers. Some lymphocytic nodules were present in the fibrous tissue, and giant cells of the type associated with foreign bodies. No typical tuberculous giant cells were found and no tubercle bacilli. In addition to a large quantity of amorphous dark brown pigment, numerous golden asbestosis bodies were seen, the majority of them embedded in fibrous tissue. If the fibrosis was less advanced, many were seen to be in clumps in the alveoli (Fig. 3). Varying in size and shape, the majority showed a large clubbed head, a segmented body, and a tapering tail. The hilum glands were pigmented, but were only slightly enlarged and no asbestosis bodies were found in sections

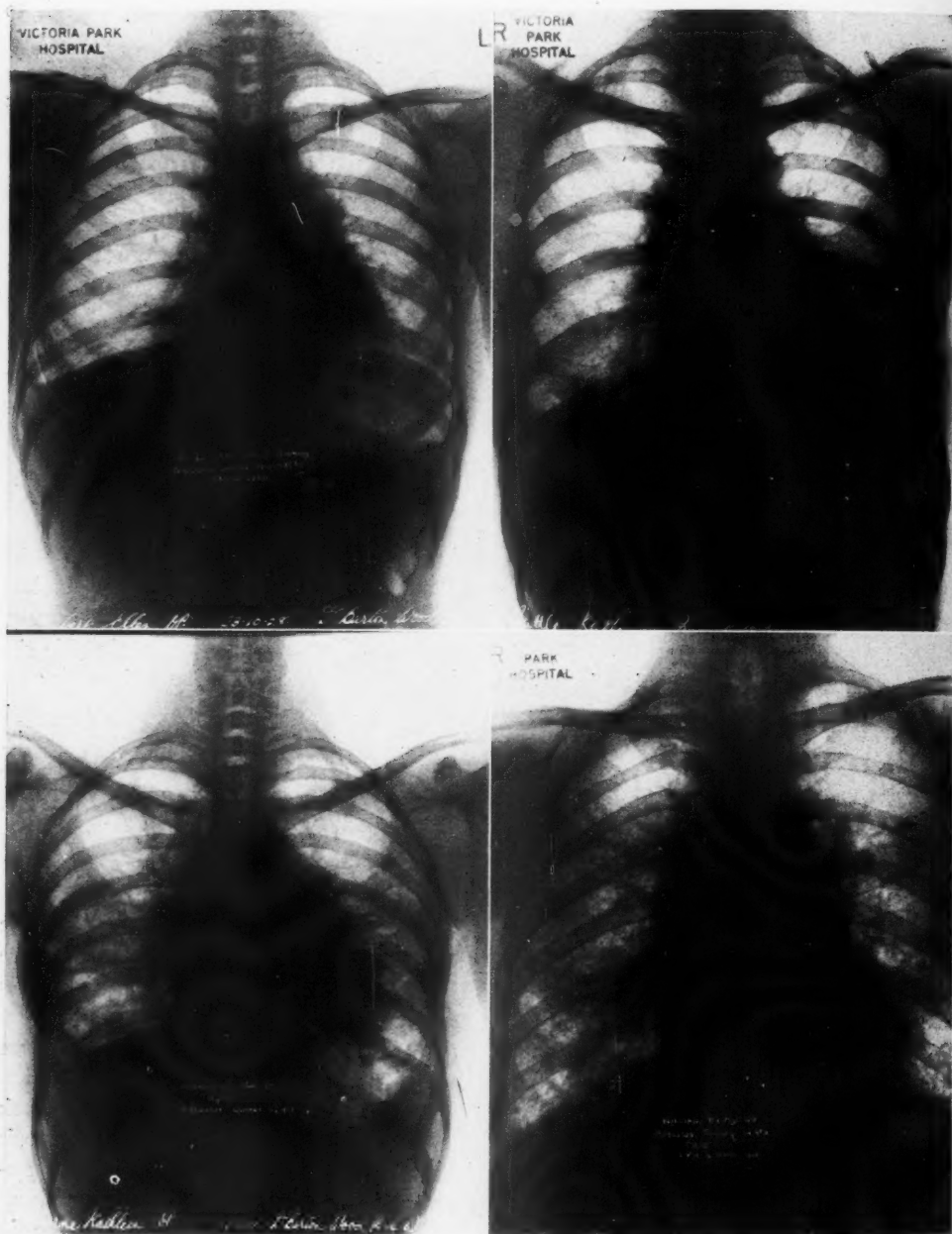


Fig. 4 (upper left). Roentgenogram of chest of asbestos worker, exposed for four years.

Fig. 5 (upper right). Roentgenogram of chest of patient who showed asbestos bodies in the sputum twelve years after leaving the factory.

Fig. 6 (lower left). Roentgenogram of chest of individual who has worked six and a half years in asbestos.

Fig. 7 (lower right). Roentgenogram of chest of individual who has been an asbestos worker for fourteen years.

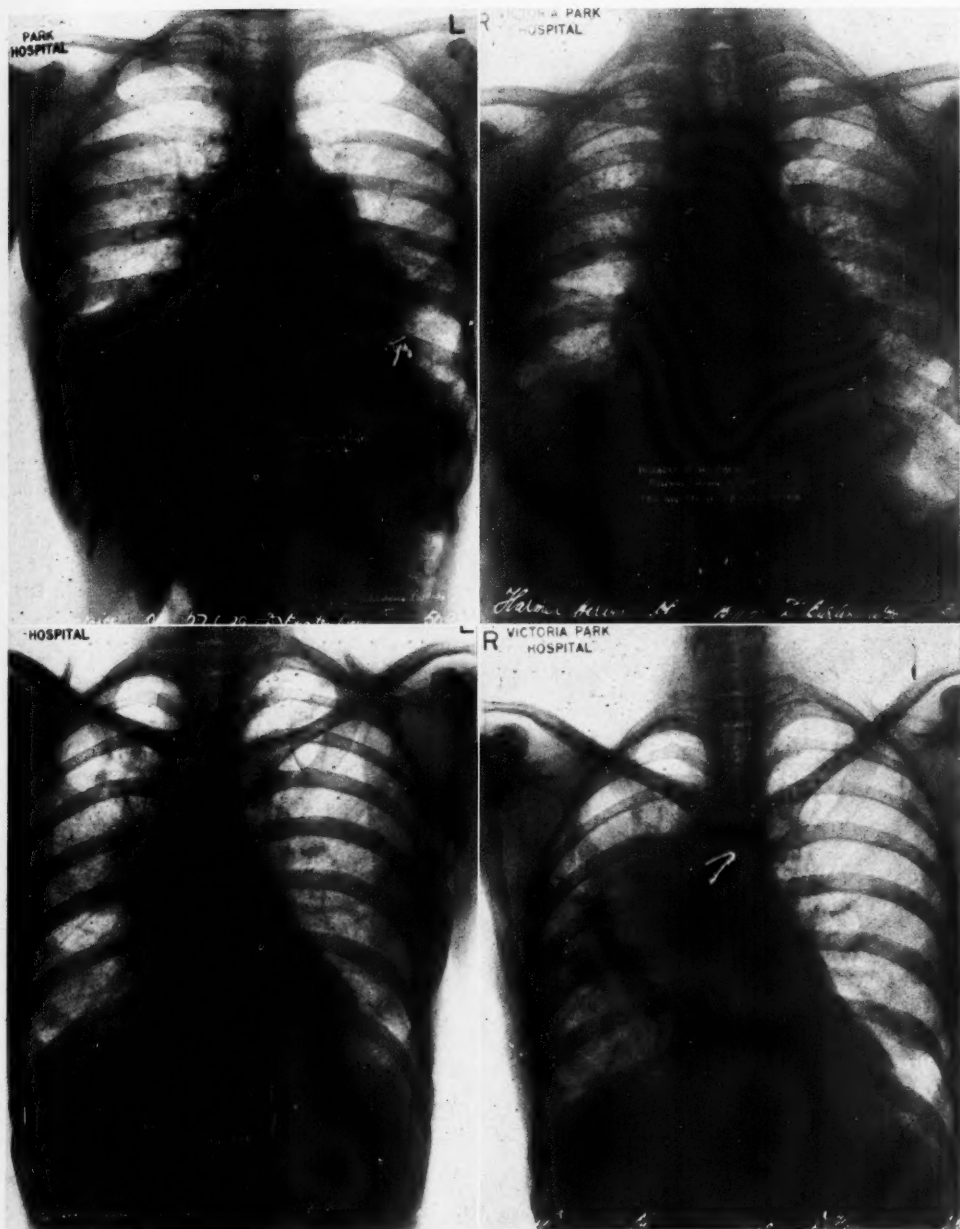


Fig. 8 (upper left). Roentgenogram of chest of patient who was an asbestos spinner for twelve years and had symptoms for three years.

Fig. 9 (upper right). Roentgenogram of chest of patient who was an asbestos worker for seven years. He was under observation for two years, when he developed tuberculosis.

Fig. 10-A (lower left). Roentgenogram of chest of patient who for thirteen years was an asbestos worker. Tuberculosis developed. (Cf. Fig. 10-B.)

Fig. 10-B (lower right). Tuberculous lesion in patient shown in Figure 10-A.

prepared from them, neither were any found in the sections prepared from the liver, spleen, and kidney. The fluid expressed from the lung was found to contain asbestosis bodies and also free asbestos fibers.

It is seen that these asbestosis bodies are found mainly in the alveoli of the lungs. They consist of a central asbestos spicule surrounded by a colloidal aggregate of blood protein and possibly an iron salt, and one wonders whether their formation may not be a protective action on the part of the body. One can easily imagine that these fibers which are inhaled right into the alveoli can set up an inflammatory reaction in the pleura. One of the first radiologic signs is often a dry diaphragmatic pleurisy.

RADIOLOGIC APPEARANCES

The radiologic appearances of pulmonary asbestosis are usually quite typical in the radiogram when the condition is well advanced. In the early cases they may easily be overlooked, especially when one observes the radiogram without any knowledge of the clinical history. This latter method of observation is always practised in our hospital, so as to give the physician an unbiased opinion of the radiologic appearances. A well-advanced case shows some of the appearances enumerated in the next paragraph.

The diaphragmatic movement is limited; its outline tends to be indistinct and is sometimes uneven. There is clouding in the costophrenic angle due to thickening of the pleura, a thickening often seen to extend along the costal margin on both sides to the apices. The heart outline is often poorly defined, showing a ragged outline due to changes in the lung around the pericardium (Fig. 4). It is not displaced in position unless the degree of fibrosis is greater on one side than on the other. A prominence

has often been noted in the left auricular or pulmonary area. No appreciable displacement of the mediastinal contents is usually apparent. The lung fields at first show a slight relative increase in density in the lower zones, due to a lack of air entry, without any appreciable accentuation of the bronchial striations (Fig. 5). Sometimes some small calcareous deposits are seen scattered in the lower zones of approximately the same size as the calcifying tubercle, but they have a slightly lesser density and are irregular in outline. Later, there appears a patchy increase in density in the lower zones, which may also involve the mid-zones, producing a fine network of fibrosis (Figs. 6 and 7), which does not appear to be of a bronchial type but, rather, alveolar or perivascular.

These appearances are described in contrast to the coarse fibrosis seen in silicosis, combined with the occurrence of fairly large nodules of varying density in the lung fields and around the hila. The fact that there are comparatively few visible changes in the radiogram in asbestosis when compared with silicosis does not in any way mean that they are of a less serious nature or less advanced, as the density of the silicotic lesion would appear to be greater and the fibrosis of a coarser character, involving localized areas of the lung, whereas in asbestosis the fibrosis would appear to leave very little intermediate undamaged lung (Figs. 9, 10-A, and 10-B).

The study of this subject has emphasized to me the importance of comparative radiography of the chest (10). One hopes in the future that it will be made possible for us to examine the workers before they commence their employment in factories where asbestos is used, so that a comparative study can be made of the lung condition at yearly intervals. When making this examination it will be essential to employ the method of comparative radiography which we have at-

tempted with considerable success during the past three years at the City of London Chest Hospital.

All these patients, having symptoms, came voluntarily to the hospital, so it must not be expected that such gross changes will be discovered by a routine examination of a group of workers from an asbestos factory.

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TEMPERATURE DISTRIBUTION IN LOCAL DIATHERMY TREATMENTS

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BY THE majority of clinicians, the therapeutic value of diathermy is attributed to the production of heat within the tissues, resulting in a rise in temperature. Hence it is of importance to know the actual rise in temperature during a treatment in order to prevent damage to the tissue by too high a temperature, and yet to have a sufficient rise in temperature to be of therapeutic value.

Two types of diathermy electrodes are in general use. One is an electrode of pliable tin. The other consists of a felt pad soaked in electrolyte and applied to the skin, connection to the diathermy machine being made with copper gauze sewn to the outer surface of the pad. It has been reported that apparently greater heating is produced with a metallic electrode. Bordier (1) has observed greater perspiration and redness of the skin with a metallic electrode than with the saline pad. By inserting a thermometer through an incision in the skin over the pectoralis major, Simon (2) has observed a similar effect. In the present paper, we have investigated further the problem of the temperature distribution at the surface and in the tissues below these electrodes. The temperatures were measured by thermocouples within number 22 hypodermic needles, soldered to the point of the needle, a method used by Bazett and McGlone (3). The thermocouple circuit is similar to the circuit of Clark (4).

Preliminary experiments were carried out on dogs and are reported elsewhere (5) with all the technical details. On human subjects, one type of electrode was placed on the skin over the vastus lateralis muscle, while an electrode of the other type was placed in the corresponding position on the

other thigh. Both electrodes had the same area of 60 square centimeters. A large metallic electrode, 400 sq. cm. in area, was placed on the inside of each thigh and joined to the one opposite by a copper wire. The outer electrodes, beneath which the temperatures were measured, were connected to the diathermy machine. Thus the same diathermy current would traverse an identical tissue path, the only differences being due to the two types of electrodes. This manner of comparing electrodes also eliminated variations due to fluctuating currents, variations in room temperature, and errors in duration time of treatment, since the same errors would affect both electrodes simultaneously. Two thermocouple needles were inserted into the tissue beneath each electrode. One thermocouple needle was inserted subcutaneously while the other was placed within the muscle approximately 0.75 in. from the surface. A thermocouple was also placed on the surface between the skin and the electrode. The three thermocouples beneath each electrode are referred to in the curves in Charts I and II as surface, subcutaneous, and intramuscular thermocouples.

Before being used, the pad electrode was soaked in a 10 per cent sodium chloride solution. With this concentration of saline, no appreciable surface heating occurs (6). After a few preliminary readings, the current was turned on and continued for an hour. Temperature measurements were taken during the passage of the diathermy current and are recorded in the curves (Charts I, II). The temperature in degrees centigrade and Fahrenheit is plotted on the ordinate and the time in minutes on the abscissa. The rapid cooling of the tissues, after cessation of the current and removal

of the electrode, is to be noted by the decrease of the subcutaneous and intramuscular temperatures.

Two curves are shown which are representative of the results obtained. In Chart

than the corresponding temperatures below the saline pad electrode.

The temperatures of the deeper tissues (intramuscular temperature) below the metallic electrode rise more rapidly to the

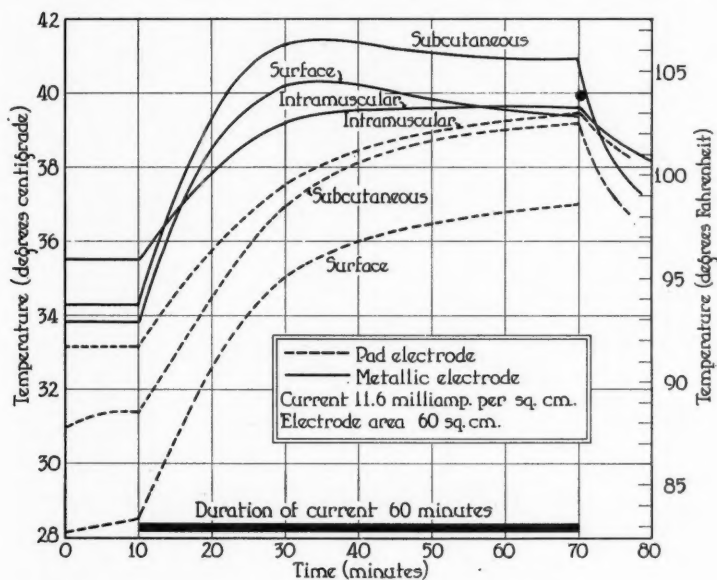


Chart I.

I are plotted the average results of four experiments for a current density of 11.6 ma. per sq. cm. of electrode surface. The total current was 700 ma. with a circular electrode of 60 square centimeters. In Chart II the results are given for the same electrodes under the same conditions but with less current, the current density at the electrodes being 10 ma. per square centimeter. The subjects were students attending the university and were normal in all respects. Some measurements were made on general paretics, but their results resembled very closely those obtained from normal subjects.

RESULTS

For a short treatment of 20 minutes with diathermy and dosages to 12.0 ma. per sq. cm., the subcutaneous and intramuscular temperatures beneath a pliable tin electrode are from 1 to 5 degrees centigrade higher

equilibrium values than the intramuscular temperatures below the pad electrode. The intramuscular temperature below the pad slowly approaches the equilibrium intramuscular temperature beneath the metallic electrode.

The surface heating is much less with the pad electrodes. This may be attributed to the cooling effect due to evaporation from the pad.

After an initial rise, lasting about 20 minutes, the subcutaneous and surface temperatures below the metallic electrode decrease to a final equilibrium value. This was observed in previous experiments of Stenström and Nurnberger (7).

CONCLUSIONS

For a short treatment lasting about twenty minutes, a greater temperature can be obtained with a metallic electrode, since

the rise in temperature is more rapid. This would explain the apparently greater heating effects observed by Bordier with the metallic electrodes. Thus, by using pad electrodes, the same deep heating effect is ob-

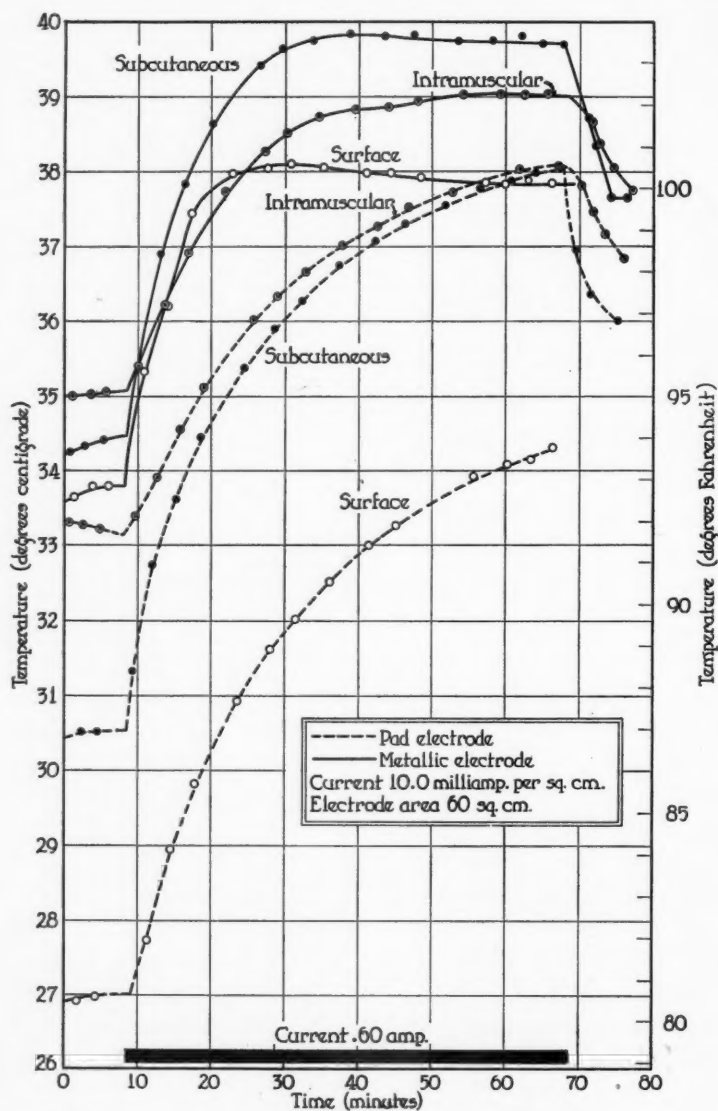


Chart II.

metallic electrodes, since his treatments were of short duration. For a treatment lasting an hour or longer, the deeper temperatures beneath the saline pad increase to

tained with less superficial heating in a long treatment. In cases where a higher deep temperature is desired with a low superficial temperature, the pad electrode is to be

recommended with a treatment of one hour or longer. For rapid superficial heating, the metallic electrode is used. In all experiments on dogs and human subjects, no superficial burns occurred with pad electrodes. Using high current values on dogs, contact burns took place beneath the metallic electrode. No burning was ever observed with saline pad electrodes. Hence the saline pad is advantageous in that better contact is obtained. Care must be taken, however, to use a saline concentration of 10 per cent or greater, and to keep the electrode moist.

We are very much indebted to Dr. W. K. Stenström, of the Department of Biophysics, for his advice and suggestions. We also wish to acknowledge the loan of a diathermy machine from the General Electric X-ray Corporation.

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VERTEBRAL ANOMALIES¹

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RECOGNITION in the living subject of anatomical variations in the spine, which are many and have been known for centuries, is ultimately based upon X-ray evidence. Practically all writers seem to agree that comparatively few variations appear in the cervical and dorsal region compared to the greater percentages that occur in the lumbar and sacral segments. The presence of these changes in the vertebral column when traumatism or pseudotraumatism has occurred, may be mistaken for traumatic as well as non-traumatic lesions of the spine, or other pathologic conditions which may be due to trauma or other causes.

Many years ago we heard much about railway spine. To-day this same term, used first by Erichsen in 1868, has insinuated itself among a larger class of people, including the medical profession, as the so-called industrial spine. The occurrence of actual or alleged injuries is of great interest to all medical men, especially to the surgeon and roentgenologist. Anomalies and anatomic variations are of particular interest when one is endeavoring to determine the true etiology and prognosis of back sprains or other injuries to the spine.

Vertebral anomalies were noted in 1,122 roentgenograms of the lumbar vertebrae and sacrum. This number represented the negative genito-urinary examinations in a consecutive series of approximately 8,000 patients, who were subjected to X-ray examinations in the Scott and White Clinic. During this period, comparatively few roentgenograms were made of the cervical and dorsal spine except following alleged injuries, therefore it will be impossible from our studies to give any definite data regard-

ing the exact percentage of occurrence of vertebral anomalies in these regions.

That these cases were sent to the X-ray department for genito-urinary examinations would indicate that the discovery of these anomalies was quite accidental as they could not possibly have any bearing on the well-being of the individuals, and their occurrence is probably of scientific value only. In this connection, I should like to stress that we should continue to report every possible anomaly. I suggest that we speak of these as normal variations of the spine instead of congenital anomalies, because our studies as well as those of many others seem to indicate that individuals having these peculiarities of development are in a way just as normal as those having the standard pattern. I should like to stress also, first, that one should always endeavor to determine if there has been sufficient trauma to produce the alleged injury, and, second, if the violence or trauma was directed in such a manner as to produce the particular lesion.

It must be recognized that any attempt to classify accurately the anomalies of the lumbar region from a study of this region alone is unreliable. As an example, 50 of the 1,122 roentgenograms studied showed an increase to 6 in the number of lumbar vertebrae, and, in 13 cases, 4 lumbar vertebrae were noted. Variations in the total number of vertebrae occur more or less frequently, although the total number of cervical segments has been found practically constant. The number of presacral or movable vertebrae is normally 24 (7 cervical, 12 dorsal, and 5 lumbar). The total number of presacral vertebrae may remain the same, but there may be a variation in the number found in the different regions because of the

¹Presented before the Texas Railway Surgeons' Association, Mineral Wells, May 5, 1930.

subtraction from one region and the addition to another. It is true that frequently we find instances of 11 thoracic with 6 lumbar, and 13 dorsal with 4 lumbar, the total number of movable vertebrae remaining unchanged.

Bardeen, after a study of 1,059 specimens including 75 of his own, found that numerical variations occurred in about 16 per cent of vertebral columns. Of these, 7.5 per cent had compensated variations and 8.7 per cent uncompensated, equally divided between increase and decrease of segments. Bardeen stated there was no evidence that intercalation of a whole vertebra occurred.

In 1923, Willis examined 748 columns and found 23 presacral vertebrae in 5 cases, or 0.66 per cent, and 25 presacral vertebrae in 26 cases, or 3.477 per cent. Of the remaining 717 cases, 5 presented a lumbar decrease compensated by a thoracic increase, and 4, a lumbar increase compensated by a thoracic decrease, the total number of presacral vertebrae remaining unchanged. During 1929, Willis extended his report to include 1,471 skeletons and found that 1.5 per cent had 23 presacrals, and 4.1 per cent had 25 presacrals, leaving 94.4 per cent with the model number of 24 presacral vertebrae.

Analysis of our cases reveals 63 cases, or 5.7 per cent, showing a decreased and an increased number of segments combined. Fifty cases, or 4.45 per cent, showed 6 lumbar vertebrae, and 13, or 1.1 per cent, showed 4 lumbar vertebrae.

An extra half vertebra, hemivertebra, wedge-shaped in appearance, is occasionally met with and is not infrequently mistaken for a fracture. It may involve the cervical, dorsal, or lumbar region. In the dorsal region, it is frequently associated with scoliosis, there being a reduction in the number of ribs on one side.

Extra ribs appear in the lower cervical or upper lumbar regions, or they may be attached to extra vertebrae. Our own series of 1,122 cases showed lumbar ribs in 73

cases, or 6.5 per cent, 2.5 per cent unilateral and 4 per cent bilateral. We must recognize limitations of this study when confined to a single region, as our study necessarily is, because a rudimentary twelfth rib—occasionally its complete absence—is not an uncommon condition, resulting in a short eleventh rib. This may be considered as the twelfth rib, and, if the count is made from this point, naturally 6 lumbar vertebrae will be noted.

Keith reports that about 2 per cent of vertebral bodies show the nineteenth (twelfth dorsal) segment without ribs, and approximately from 6 to 8 per cent show that the twentieth (first lumbar) segment carries ribs. Based on X-ray data of this region alone, there is an error of from 8 to 10 per cent in estimating the variation in the number of lumbar vertebrae.

In this connection, we have attempted to note the number of rudimentary dorsal ribs, considering as rudimentary ribs shorter than 6 cm. which present the characteristics of a dorsal rib. We reported rudimentary dorsal ribs as occurring 98 times, or 8.73 per cent, at the same time recognizing that it was practically impossible to report accurately the number of rudimentary dorsal ribs without X-ray data on the entire thoraco-lumbar region.

Lumbar ribs, which are found in 6 to 8 per cent of the cases and are of anatomic rather than of clinical significance, should be distinguished from fractures of the transverse processes. Fractures are usually multiple and show as an irregular line, whereas in the case of lumbar ribs there is an articular surface on the rib as well as on the vertebrae, and the first lumbar nearly always carries the rudimentary rib.

There may be an absence or partial absence of one or more ribs, or adjacent ribs may be fused. A mild form of fusion is frequently seen near the sternal end, where a rib may flare considerably before its attachment to the costal cartilage.

This study on anomalous ribs would not be complete without mention of cervical ribs. These are congenital bony deformities, rarely causing symptoms until adolescence or later in life. The transverse process of the seventh cervical is often of unequal length on the two sides. When it is of exaggerated length, it can produce disturbances in the areas supplied by the brachial plexus similar to those resulting from cervical ribs (Köhler). This deformity is usually bilateral and occurs more frequently in women than in men. Cervical ribs usually arise from the seventh cervical vertebra and occasionally from the sixth cervical vertebra. There is a rather marked variation in size, and usually they appear longer on the film, due to foreshortening of their shadows. The length of the cervical rib is not always an index to the symptoms. Henderson estimated that only 10 per cent produce symptoms.

Abnormalities of the lower portion of the spine, particularly of the fifth lumbar and sacrum, have long engaged the attention of the orthopedic surgeon and roentgenologist. In fact, congenital anomalies of the fifth lumbar and sacrum have been observed so frequently that there has developed a tendency among roentgenologists to discount their significance. Brailsford reports the presence of such anomalies in 26.4 per cent of a series of 3,000 cases examined.

Sacralization is a projection downward to the ilium of the transverse process of the last lumbar vertebra. We have included the cases of true sacralization, namely, bony union between the transverse process of the last lumbar and the sacrum, as well as those cases in which the transverse process is very large and to all intents and purposes sacralized, though there may be a line of demarcation between the transverse process of the last lumbar vertebra and the sacrum. We have made no attempt to distinguish the lumbarized sacral body, since this condition

is not common and the two are so closely allied.

In our series of 1,122 cases, 9.2 per cent showed sacralization, 4.2 per cent being unilateral and 5 per cent bilateral. In a study of 3,000 cases, Brailsford found that 8.1 per cent showed sacralization, 3.4 per cent being unilateral and 4.7 per cent bilateral. In a series of 12,000 roentgenograms of the spine, Sutherland reported the incidence as 4.5 per cent. O'Reilly reported it occurring in 8.5 per cent of a series of persons who complained of painful backs, and in 14 per cent of a series of normal adults. This discrepancy is difficult to explain. Moore states, "Anatomically and architecturally the sacralized formation appears stronger and more able to resist strain than the usual arrangement."

Spina bifida may occur in any portion of the spine; however, next to the sacrum, the lower lumbar segment is the most frequently implicated. The cleft may be small, or it may be wide and associated with extension of the membranes and sometimes the cord. Sutherland found spina bifida occulta of the last lumbar or first and second sacral in 5 per cent of 12,000 cases. Baetjer found a failure of fusion of the neural arch of the last lumbar or first and second sacral segments in 15 per cent, Wentworth, in 8.1 per cent, Willis, in 4.28 per cent. Cushway and Maier found spina bifida occulta in 17.25 per cent of 931 men with symptomless spine who applied for positions as switchmen and firemen on the Belt Railway of Chicago. Our own review of 1,122 negative genito-urinary roentgenograms of the lumbar spine shows an incidence of spina bifida in 23.9 per cent. The 267 cases were distributed as follows: 210, or 78 per cent, involved the sacrum; 40, or 15 per cent, involved the last lumbar; and 17, or 7 per cent, involved the last lumbar as well as the sacrum.

There seems to be little relation between

the extent of the defect and the signs or symptoms. Occasionally such symptoms as reflex disturbances, deformities of the foot, asymmetry of the muscles, disturbances of sphincter control, motor and sensory disturbances, incontinence, enuresis, and trophic ulcers, are ascribed to spina bifida occulta (Woltman).

In addition to recognizing these abnormalities and properly classifying them, it is important from the standpoint of the surgeon and roentgenologist to determine, as far as possible, if the congenital anomalies, particularly of the lumbosacral region, are conducive to injury, or, when injuries have occurred, if the anomalies played a part in, or delayed, recovery.

In this connection, Bohart discusses anatomic variations and anomalies from the standpoint of prognosis and length of disability. He states that, during the past three years, the entire spinal columns of all applicants for positions on the Belt Railway Company of Chicago have been roentgenographed. Approximately 1,000 men have been examined, 44 per cent of whom showed variations and anomalies. Only 12 of the men showing anomalies of the spine have suffered an injured back. Sacralization and spina bifida have not proved to be a hazard in any of the cases.

Bohart concludes as follows: "A general summary of practically 1,000 symptomless spines shows approximately 44 per cent of anomalies and variations, spina bifida occulta being the most common variation noted, and sacralization next in frequency. With the exception of spines showing liping or spur formation, there does not seem to be any abnormal disability or any increased tendency to injury."

No doubt backaches and injuries have too often been ascribed to the discovery of some congenital malformation, as it is convenient to have something abnormal present with which to satisfy ourselves in making a diag-

nosis. It must be remembered, however, while these patients have had their anomalies all of their lives, not all of them have had backache all their lives.

Errors of development in the structural formation of the various segments of the vertebral column occur quite frequently. In the majority of instances, congenital anomalies are discovered accidentally and are symptomless. When discovered following actual or alleged injuries, anatomic variations become of the greatest importance. There can be little doubt that damages occasionally have been awarded against industries due to the fact that a previously existing developmental defect was considered to be the direct result of actual injury or else the question of injury could not be definitely ruled out. Therefore, every corporation employing a great number of people engaged in hazardous occupations should roentgenograph every potential employee's back before he starts to work, and record the presence of anomalies, the majority of which are symptomless.

SUMMARY

1. The total number of cervical segments has been found to be practically constant.

2. Fifty of the 1,122 roentgenograms studied showed an increase to 6 in the number of lumbar vertebrae. Only 4 lumbar vertebrae were noted in 13 cases.

3. The number of presacral vertebrae (normally 24) may show a variation in the number found in the different regions because of subtraction from one region and addition to another.

4. Hemivertebra, wedge-shaped in appearance, is occasionally met with and is not infrequently mistaken for a fracture. This condition most often involves the lumbar region, but may involve the dorsal and cervical segments. In this series three cases were located in the lumbar region.

5. Lumbar ribs are found in from 6 to 8 per cent of the cases. They should be distinguished from fractures of the transverse process. Lumbar ribs show a smooth, articular surface on the rib as well as on the vertebra, whereas fractures are frequently multiple and show an irregular line.

6. Nine and two-tenths per cent of the 1,122 cases examined showed sacralization, 4.2 per cent being unilateral and 5 per cent bilateral.

9. Spina bifida may occur in any portion of the spine; however, after the sacrum the lower lumbar segment is most frequently implicated.

Spina bifida was noted in 23.9 per cent of the 1,122 spines. The 267 cases were distributed as follows: 210, or 78 per cent, involving the sacrum; 40, or 15 per cent, involving the last lumbar; and 17, or 7 per cent, involving the lumbar as well as the sacrum.

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PNEUMOTHORAX¹

A CLINICAL AND ROENTGENOLOGIC CONSIDERATION

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THE object of this paper is to present various findings in the human chest in connection with the presence of air in the pleural cavity, especially as observed in cases of pulmonary tuberculosis. We do not expect to present any new or unusual facts. We fully realize that to many of the roentgenologists and those intimately connected with the work of tuberculosis sanatoria this may be tiresome repetition; yet it seems to us that a brief review of the subject of pneumothorax and the importance of roentgenologic procedures in that connection may be of value.

Although therapeutic pneumothorax was advocated by James Carson, of Liverpool, in 1821, it was not put into practice until the 80's. It was first recommended upon theoretic grounds, the elasticity of the lungs having been recognized. That this theory was based upon sound fact was proved by the observation of many cases of spontaneous pneumothorax and their improvement subsequent to its development, although we now recognize the danger and possible fatalities which may occur following a rupture of the lung.

From 1880 to 1900 was a period of gradual development and clinical experimentation. The names of Potain, Toussaint, Forlanini, Cayly, and Murphy stand out during this time. In 1901 Lemke reported a series of fifty-three cases treated in this manner, using the trocar and cannula method as advocated by his teacher, John B. Murphy. Brauer, who has since done much to advance the knowledge of this form of therapy, reported his first cases in 1905 and

1906. The introduction of the water manometer by Saugman in 1904 was an important event, although Potain used a manometer in his work and recommended a pressure between atmospheric and 7 mm. of mercury.

The discovery of the X-ray by Conrad Roentgen in 1895 was an important event in the history of pneumothorax, since from that discovery have developed the modern methods of roentgen-ray examination of the chest, which are so important in the practical application of collapse therapy.

Artificial pneumothorax in the treatment of pulmonary tuberculosis is unique for two reasons: first, it is a method which may be used with hope of success in advanced as well as in early cases; second, it is a method in which there is greater unanimity of opinion as to its application, technic, and utility among the authorities than often obtains with a therapeutic procedure.

Benefits are derived from pneumothorax therapy because it releases the lung from expansion, compresses, and greatly reduces in size the diseased area, and in some manner mechanically prevents the absorption of toxins. Consequently, fever, sweats, malaise, and wasting are checked, and general improvement of the patient follows.

Production of artificial pneumothorax is indicated in progressing, moderately advanced, or advanced cases of pulmonary tuberculosis, but is not applicable to all of these. However, it seems probable that every advancing case is or has been at some time in its course suitable for this form of treatment. Success is dependent upon proper selection of cases. The most suitable field for its application is in that group in which

¹Read before the Radiological Society of North America at the Sixteenth Annual Meeting, at Los Angeles, California, December 1-5, 1930.

there is severe disease in one lung while the other is found free or nearly free upon physical examination. These cases seem to be hilum tuberculosis in the adult and are essentially chronic in course, presenting few or no symptoms until the disease is well advanced. The X-ray will always show some evidence of involvement of the opposite lung, which is, however, usually quiescent or relatively so.

Chronic apical tuberculosis presents a more limited field of application because of the tendency to earlier involvement and greater degree of activity of the opposite side. Hence early decision is important. In acute tuberculous lesions, the prognosis is so bad that any procedure is justifiable which offers even a slight hope that success may follow. Bronchopneumonic and caseous bronchopneumonic cases may be sufficiently one-sided for pneumothorax, although the pneumonic lung is not mechanically adapted to collapse. When decided upon, a satisfactory collapse is of vital importance to this class of case.

Pneumothorax is often of value in the control of hemoptysis, especially in severe recurring hemorrhages, and may be an emergency measure for bleeding not otherwise controllable.

It is indicated early when there is a laryngeal involvement and no contra-indications, since the removal of toxemia, decrease of cough, and disappearance of the tubercle bacilli from the sputum will greatly benefit this local condition.

When rupture of the lung occurs, maintenance of the pneumothorax may be advisable after the site of the rupture has healed. When empyema has developed, it is good practice to convert it into a closed pyopneumothorax, since this is a condition requiring conservative treatment in order to prevent the development of a suppurating cavity which would be impossible to heal. Whether or not to replace a serous effusion with air is a question of judgment in the individual

case. It may become necessary in order to prevent or reduce to a minimum the formation of adhesions.

When dealing with chronic cavitations without toxemia, the production of a collapse must be carefully considered. Probably it should be advised if the film shows a cavity measuring an inch or more in diameter.

Economic factors, lack of co-operation by the patient in carrying out proper sanatorium régime, and the necessity for reducing infective sputum for the good of the home or community may be factors in the decision as to whether or not to produce a collapse in any given case.

Miliary tuberculosis is never suitable for artificial pneumothorax. Far advanced laryngeal tuberculosis, extensive intestinal involvement, pronounced emphysema, and asthma, or severe cardiac or renal disease are contra-indications for its production. It is never indicated in early phthisis, since the dangers and risks far outnumber benefits which can be expected. In most cases the quantity and location of the foci of tuberculous involvement, the degree of activity of the less involved lung, the presence or absence of ulcerative lesions, together with the degree of response to other forms of therapy, are the factors upon which the decision rests.

From this résumé, one is impressed with the necessity for adequate fluoroscopic and roentgenographic examinations in the selection of cases and the application and control of collapse therapy. In the initial production of an artificial pneumothorax, it is dangerous not to employ the X-ray on account of the possibility of superficial cavitations, with the attendant danger of rupture of the lung and escape of infectious material, with ensuing empyema.

Satisfactory films, preferably stereoscopic, will show the degree of collapse obtained; the presence, location, and extent of adhe-

sions; the location, size, and number of cavitations; the development of pleural effusions; and the progress of the disease in the contralateral lung. Fluoroscopy should be employed soon after a filling and at intervals thereafter to aid in determining the rate of absorption and the proper time for refills.

Thus we see that for the proper correlation of the X-ray findings, the physical examination, and the clinical course, absolute co-operation between clinician and roentgenologist is essential.

The cases studied in this series have been of patients in a sanatorium of but fifty beds, and our films were selected from the files of this institution.

First pneumothorax administered at Sunny-slope, Nov. 3, 1920

Patients treated Nov. 3, 1920, to Nov. 5, 1930560

Cases in which pneumothorax was at-

tempted	31
Failures	8
Deaths since receiving pneumotho- rax (all far advanced: pneumo- thorax offered only as last resort)	5
Deaths caused by pneumothorax.....	0
Cases of spontaneous pneumothorax.....	7
Before admission	1
Complicating artificial pneumotho- rax	2
Deaths immediately following spon- taneous pneumothorax.....	3
Deaths following spontaneous pneu- mothorax after 3-year period.....	1
Patients now living after having had spontaneous pneumothorax..	2

Editor's Note.—Since the return of the authors' proof, word has been received at the Editorial Office of the sad death of E. T. Edgerly, M.D. The readers of this paper will, I am sure, feel a doubly sympathetic interest in this, one of the last publications of their co-worker.

SOME OBSERVATIONS ON THE TREATMENT OF BONE SARCOMA¹

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I WISH to convey to you some observations I have made and some lessons I have learned, due, probably, more to my failures than my successes, in treating sarcoma of the bones during the past 25 years. Some practical point may suggest itself which may be helpful in treating similar cases in the future. We must admit that we have made no remarkable progress during the past few years, either by surgery or radiotherapy, in treatment of this malignant form of tumors. Statistics still show a too frequent recurrence and a remarkably small number of five-year cures.

In 1910 Dr. Joseph C. Bloodgood, who has given the subject unlimited study, pointed out that only 4 per cent of the periosteal sarcomas survived the five-year period. Forty-two of the 52 cases of bone sarcoma died within one year, the fatality being mainly due to the early metastases in the lung. Whenever metastases in the lung occur, the case may be regarded as hopeless, because metastases are usually spread through the entire lung structure. Somewhat different is the condition in primary sarcoma of the lung. Here we often have a single, well-defined tumor which may grow to the size of half the capacity of the chest without metastases in any other part of the body. Such cases may at times be considered suitable for surgical intervention. As early as 1883, Kroenlein, of Zürich, operated on a young woman, aged 18, in whom the sarcoma invaded the chest wall and the lung. He excised the tumor and sutured the lung with catgut. Four years later he operated the same patient successfully, resecting a recurrent tumor and a large section of the lung. Three years after this he reported the

patient to be still perfectly well. Helfrich went still further; he extirpated a sarcoma of the chest wall with the lower and middle lobes of the lung, after he had ligated them at the hilum.

The five-year period in which to regard a cancer case cured, adopted by surgeons and radiologists, is a reasonable one, quite satisfying in cases of carcinoma, since as a rule the patient is of advanced age and five years more mean a great deal to him. But in cases of sarcoma, which usually affects young individuals, the early recurrence strikes them in the best years of life and thus makes their misfortune doubly felt. The average age of sarcoma of the bones, as given in a report of 109 cases by Henry Meyerding (Mayo Clinic, XIII, 916), is 28 years and 3 months. Thirty-four cases of this series occurred between the ages of 11 and 20, and only 6 cases after 50 years of age, while the average age of carcinoma from world statistics is about 48, very few occurring before the age of 20.

Thus we observe that sarcoma prefers the young and carcinoma the older. It would be interesting to know the cause of the predisposition of these two types of malignancies to certain ages.

There is another interesting factor worth considering in this connection, namely, that sarcoma and carcinoma rarely coexist in the same individual. Ewing states that such cases have been observed and a number have been published by Herzheimer, who found, however, that only five would stand critical analysis. In his experimental work on carcinoma transplants in rats, Leo Loeb reported the transformation of carcinoma cells into sarcoma, with gradual and final disappearance of the epithelial cells. Ewing states that it is difficult to explain the carcinoma-sarco-

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matous structure in man and the lower animals, the most plausible cause being the transformation of epithelial cells into spindle cells. I have never seen sarcoma and carcinoma coexisting in the same patient. I have questioned many of my confrères, but none could recall having met with such a case. This is an interesting factor and suggests investigation. Is it not possible that young individuals have a natural immunity to carcinoma, and that immunity to sarcoma develops as age advances?

In dealing with cases of bone sarcoma, two outstanding rules must be constantly followed: first, the earlier the diagnosis of the disease, the better chance the patient has for a cure. One should not wait for developments. Delay is too dangerous. The X-ray findings, and especially stereoscopic roentgenograms of the parts affected, will usually establish the diagnosis quite early and give the patient a chance to have the tumor removed before metastases have taken place. The second rule is perfect co-operation between the surgeon and the radiologist. The radiologist should be consulted before the operation is undertaken in order to determine whether or not pre-operative radiation is indicated, and the operation should be planned so as to make the post-operative treatment most effective.

While surgeons cannot be expected to be expert radiologists, they should be sufficiently informed in this science to be able to judge for themselves what they may expect from radiologic treatment. I have found this so essential that I joined several radiologic societies and attended their meetings and congresses in order to become better acquainted with facts. This has been a great help in my work and I am convinced that my patients have been very much benefited as a result.

Having thus emphasized the necessity of early diagnosis and co-operation between radiologist and surgeon, I wish also to

point out the importance of pathologists in the case. They have worked out for us a grouping of tumors indicating their degree of malignancy. I refer to the Broders and MacCarthy classification. This classification is essential in the determination of intensity of treatment. Without this guide, we should make many an error.

Whether the case should be treated by surgery exclusively, by radiotherapy exclusively, or by a combination of the two, should be decided in advance by the tri-consultation of surgeon, radiologist, and pathologist. After a thorough discussion of all phases of the case, a certain plan should be decided upon and then followed consistently. Before the conference in each case, roentgenologic findings, especially stereoscopic films of the chest, should be at hand, because upon the findings of these the proper procedure will in a great measure be determined. It would indeed be a disappointment to the surgeon, if, after an amputation of a sarcomatous limb, he should discover that metastases in the lung had already existed at the time of the operation. A case of sarcoma in which metastases exist in the lung is, of course, incurable and an amputation is contra-indicated.

In cases in which metastases of the lung have not yet appeared, surgical intervention, when technically feasible, is indicated. The question arises as to whether an amputation of the limb is absolutely necessary to save the patient's life or whether a local operation with subsequent radiotherapy will be sufficient to accomplish the desired result. The decision of this vital question does, of course, depend upon the extent and type of the tumor in each individual case. In advanced cases, the amputation is the only logical and the safest advice. But quite often amputation is not consented to by the patient and thus we are obliged to do the next best thing and treat the case conservatively.

Just such an incident, in which the parents of a four-year-old girl refused to permit the hip resection in a case of sarcoma of the upper end of the femur, taught me that it is sometimes possible to save the patient's life and preserve the limb also. I waited until the five-year period had passed before citing the case, but now that seven years have elapsed and recurrence has not yet appeared, I desire to report this case.

Sarcoma of Femur.—A girl of four years was first examined on Sept. 27, 1923. Complaint was of gradual development of a painless swelling of the upper half of the right thigh, limping, and moderate pain on pressure over the entire hip region. The patient lost 10 pounds within two months. Examination of the chest and other organs disclosed no evidence of tuberculosis. The upper half of her right thigh was somewhat larger than the left, measuring one inch more in circumference. There was no edema, the swelling being rather resilient, but a small, harder mass could be felt on deep palpation.

A radiogram disclosed a distinct lesion in the neck of the femur and destruction of the large trochanter. A tentative diagnosis of sarcoma was made and exploration advised, with the provision that, if the case proved to be a sarcoma, amputation at the hip would be the only chance for a possible cure. The exploration was permitted, but amputation was not consented to by the parents. The exploration on Oct. 17, 1923, revealed a growth involving the trochanter shaft of the neck of the femur and surrounding tissues. No pus or sign of any previous infection was found. The entire trochanter and as much of the enlarged portion of the femur as was feasible were removed, exposure of the area involved being quite extensive. I employed a Y-shaped incision, which furnished three large skin flaps, which gave us a good opportunity to make a wide resection. Six platinum needles of radium of $12\frac{1}{2}$ mg. each (75 mg.), un-

screened and fastened on wires, were inserted deep into the excavated part of the femur. The cavity was then packed with gauze sponges and the skin flaps drawn temporarily over the denuded area and fastened in the center. The radium was removed six hours later. This would seem too small a dosage, only 450 mg. hours, for such a malignancy, but I feared that the corrosive effect of six unscreened needles, concentrated in one small space, might destroy the remaining part of the neck of the femur and thus defeat our purpose, a conservative operation. Twenty-four hours later the gauze was removed and the cavity repacked, wound being left open for later insertion of radium. The subsequent applications of radium were given on October 23, 26, 29, and November 5. Each time $37\frac{1}{2}$ mg. were inserted for four hours in different regions of the open wound. This was supplemented later by X-ray treatments, administered by Dr. B. H. Orndoff, who had charge of the radiologic treatment of the case. The wound gradually filled with normal granulations, and the skin regenerated from the borders of the wound.

The subsequent history of the case to date is very satisfactory. The patient has not only regained her weight, but has developed into a healthy and lively child. She has been carefully observed for eventual recurrences and, during the first two years, radiograms of the femur were taken at six-month intervals. The last one, which was taken two years ago, or five years after operation, shows a very interesting finding. There was almost normal regeneration of the neck of the femur, with reinforcement of the bone lining the old cavity. We assume this to be Nature's way of providing sufficient support for the body weight. We note, also, a little new growth of bone just above the cavity, and we take this to be an attempt at building a new trochanter.

Upon inquiry in November, 1930, I was

informed that the little girl, now 11 years old, is perfectly well and attending school. This is, of course, an exceptional case, and we cannot be certain that recurrence will not take place later in life.

That recurrence can take place many years after an apparent cure is illustrated by the following case of sarcoma of the wrist in which I amputated the arm in 1907 and death occurred 18 years later from sarcoma of the lung. I shall cite a primary report of it, made in the *Archives of Surgery* in January, 1925, while the patient was still alive, and will now complete the history in this final report.

Sarcoma of the Wrist, 1907, with Amputation of Arm; Metastasis in Lung 17 Years Later.—A woman, aged 30, developed a tumor of the left wrist in November, 1907. My diagnosis was tuberculosis of the metacarpal bones. I consulted Professor Senn, who diagnosed and pronounced it a very malignant type of sarcoma, advising amputation of the arm above the elbow. The patient refused the amputation, but consented to the removal of two of the carpal bones. Specimens of the tissue were examined by Professor Herzog, of Chicago, who diagnosed it as an osteogenic sarcoma. The patient, being four months pregnant, again refused amputation and I treated the wrist for a time with roentgen rays, such as were employed at that time, administered with a small gas tube run on a 12 inch coil, without any measurements of dosage or distance, "mere guesswork." There was, as might have been expected, recurrence so formidable that the woman gladly consented to an amputation but would not permit removal above the elbow; therefore, the arm was removed below the elbow. I removed the arm on June 1, 1907. She gave birth to a normal child four months later.

Six years later, when a small growth the size of a walnut developed on the scalp in the region of the occipital bone, I excised

the tumor. Microscopic examination proved it to be a *spindle-cell sarcoma*. Radium was applied in the open wound. No recurrence followed, so that in the fall of 1921, after a period of 14 years, I brought the patient before the Chicago Medical Society to demonstrate the permanency of the cure of a sarcoma.

The possibility of a mistaken diagnosis was cleared when, in February, 1924, the patient again returned, complaining of pain in the chest, loss of weight, and cough at night. In February, 1924, four small tumors developed on her scalp. One tumor was about the size of a walnut; the other three, about the size of hazel nuts. They grew quite rapidly. I removed the four growths and again left the wounds wide open, treating them with radium. The wounds healed within two months. The microscopic sections of the four tumors of the scalp were *fibrosarcoma*.

On account of the cough, my suspicion was naturally directed toward a possibility of a metastasis of the lung. To my surprise, I found by stereoroentgenogram that the entire upper lobe of the right lung was clouded by a well defined shadow and that there were two round, small tumor shadows in the lower lobe. We could not say definitely that the growth in the lung was a sarcoma, but we could think of nothing else in view of the history and the almost typical formation of the small tumors in the lower part of the lung. It was surprising, however, that the patient's general health had considerably improved since February. She received deep therapy by Dr. Orndoff for the tumor of the lung. At that time we asked ourselves:

1. Do the shadows in the roentgenograms of the chest represent neoplasms?
2. If so, are they due to sarcoma?
3. If so, is it a metastatic or an independent growth?
4. Was the growth of the scalp an inde-

pendent newgrowth or a metastatic growth from the wrist sarcoma?

5. In the same way, what relation has the shadow in the lung to the original sarcoma of the wrist and the scalp tumor of 11 years before?

Termination.—On Oct. 20, 1924, the patient coughed up small quantities of blood, and continued coughing until June, 1925, when she was suddenly seized with a severe spell and coughed up about one pint of bloody degenerated material mixed with pus. This was followed by a hemorrhage of mild degree, which stopped spontaneously. Nine days later the patient had another coughing spell with a very profuse hemorrhage, to which she succumbed within a few minutes.

I ascribe the unusual result in the case of sarcoma of the femur to the direct implantation of radium into the center of the diseased area, with the wound left open for repeated application. While I have not been so fortunate as to obtain such results in other cases of sarcoma, I believe that it is likely that small metastases in the lung, not demonstrable with X-ray films, were present. I, therefore, recommend that, in cases in which the lung appears clear of metastases, a conservative operation should be restored to whenever amputation is refused.

The open method of surgery, which I need not describe here as it has been previously published (*Surgery, Gynecology and Obstetrics*, October, 1919), is preferable to the closed, sutured method. Now, after fifteen years of its employment, especially in cases of carcinoma, I am convinced that recurrence may be prevented in a larger proportion of cases, because the post-operative radiation can be applied with greater efficacy.

DISCUSSION

DR. FRANCIS CARTER WOOD (New York): Dr. Beck's report of these cases illustrates the

point we are coming to, that is, it is not a question of *obtaining* a biopsy, it is not left to the surgeon to do as he wishes, but biopsy is a necessary obligation to the patient. The patient has a right to a diagnosis. Without a diagnosis, intelligent treatment cannot be given, and I think Dr. Beck would agree with me now that some of those cases which he watched for a time, thinking they were inflammatory but which turned out to be tumors, might possibly have been saved if he had done a biopsy promptly. Our X-ray diagnosis, of course, is much better at the present time than when these patients were operated upon, and, because a pretty definite diagnosis of sarcoma can be made, some patients can be spared a biopsy until the time of operation. But, despite this fact, the biopsy should always be available and the slide should always be a matter of record. After all, if we are going to advance in the treatment of these patients, most of whom die as we all know, we will advance only if we have the microscopic picture so that we will gradually learn which cases are perfectly hopeless from the point of view of radiation and which cases can be treated by radiation without operation. Unfortunately, even to-day our opinions are not yet codified.

I saw a patient within a few days whom an eminent pathologist and clinician had told that he should be radiated and under no circumstances should a biopsy be done nor surgical treatment given. The patient's family objected to this dogmatic statement. My opinion was that radiation treatment should be given only when we knew what the patient had, and so it was arranged that the patient would consent to whatever was necessary. A biopsy revealed an osteogenic sarcoma of the bone and cartilage which could not have been healed by radiation. The patient's lungs were free of metastases, and, by agreement with the surgeon, a high amputation was done immediately, the only possible hope for such a patient.

It might be argued that radiation would have kept the tumor quiet, but we know that such tumors do grow and that ultimately an amputation may become necessary to relieve

the patient of pain and a huge tumor. How much more important to do the amputation promptly while the tumor is still small and the patient has the minute percentage of possibility of permanent cure. Data have shown that there are only about 250 recorded cures of osteogenic sarcoma in the United States. While these patients have a minute chance, that chance should be given them, and tumors which we know are not to be influenced by radiation should not be radiated. We should reserve that for the sensitive type of growth, yet what the tumor type is can be determined only by biopsy.

DR. H. B. THOMPSON (Seattle, Wash.): I should like to report one case, now a considerable number of years old, in which a fairly

early diagnosis of osteogenic sarcoma of the lower end of the femur was made. The patient and the father absolutely refused to have amputation done. We gave heavy X-ray treatments and inserted needles directly into the bony growth, with apparently no results. The X-rays taken from time to time showed a little more bony growth as compared to soft-tumor growth, although the entire tumor increased in size. The bony growth was greater in the later stages as compared to the soft-tumor growth. The tumor finally invaded the knee joint and, on account of severe pain, the patient consented to operation. The operation was done for relief of the pain only. The case was recorded with the Bone Sarcoma Registry and, having now passed the five-year period, is to be reported very soon.

THE RESPONSE OF THE GASTRO-INTESTINAL TRACT TO EXTERNAL ELECTRIC STIMULATION

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A VERY considerable literature is available on the subject of stimulation of the colon by electric currents. This has generally been applied externally, although one author, Ott (2), applies the current by means of a saline injection in the colon. He prefers the following technic:

(1) Vibrations over "visceral reflex centers" three minutes.

(2) Injection of eight ounces saline solution in the rectum.

(3) Insertion of sigmoid electrode and application of sine wave of 11 per minute, the second electrode being placed over the colon.

Treatments are from 10 to 30 minutes' duration three times a week. This therapy is often complicated by other physical therapy procedures, as well as by the use of sodium phosphate orally. X-ray examination is used preliminary to treatment, but no mention of its use to control results is made.

Some of the authorities emphasize the frequency of the atonic colon, and specify that only the atonic colon should be treated by electric stimulation. Others apparently treat all types of colonic stasis.

Thaysen (6) says that out of 125 cases of habitual constipation, 60 per cent were of rectal etiology and not primarily colonic. Lamarque (8) states that atonic constipation is the more frequent type. He uses interrupted faradic, followed by reversed galvanic 15 minutes to one hour, one or two treatments daily, for a period of three to four weeks. He says that spontaneous evacuation frequently occurs after treatment. Delherm and Laquerrière (7) feel that electrotherapy is valuable in chronic constipation as a functional re-educator.

Results, as reported in the literature, are complicated in most cases by a number of variables in treatment. Medical treatment is the most common method associated with electric stimulation of the colon. Stewart (13) says:

Chronic Constipation.—To obtain satisfactory results in the treatment of this unusually resistant condition every mode of attack at our command must be followed. The diet, habit, time factors, and occasionally medicinal aid must all be employed with physiotherapy. In cases where the underlying cause is adhesions, the physiotherapeutic treatment to be outlined cannot be expected to attain a cure, but it may attain partial relief. In fact, the development and strengthening of the abdominal musculature and improvement in the general condition, usually following its application, are distinct assets if operation becomes necessary to remove adhesions The treatment of simple atonic constipation consists in the use of a continuation of exercises, massage, and electrotherapy.

Electrotherapy.—The musculature of the abdominal wall, and to some extent that in the walls of the intestines, may be stimulated to increased action by the contractile electric currents Uncomplicated cases of many years' duration have been made practically normal by this treatment Attention should be directed to associated conditions so often present. Among these are neurasthenia, visceroptosis, faulty posture, and the general effects of sedentary living.

Not only is the treatment complicated by a number of variables, but the results in most cases have not been checked by objective findings, although many reports are accompanied by reproductions of barium

enema plates taken before and after a series of treatments by external electric stimulation of the colon. This is not considered by the author to be satisfactory evidence in view of the well known variation in position of the colon due to position of the body, etc., as well as variations in the apparent tone due to variation in degree of filling by barium enema. It is reported by Granger, however, that "Under the fluoroscope, after a barium meal, increased peristalsis may be noted during a sinusoidal stimulation."

Otis (5) reports that, using a stomach showing an eight- to fifteen-hour retention with atony and dilation, stimulation with the Morse wave produced emptying in from two and a half to three hours as checked by fluoroscopy. He also reports that sine wave through the colon produces deeper and more frequent contractions as observed fluoroscopically.

On the other hand, Barker, Backus, and others have emphasized that, in the treatment of spastic constipation, which is more frequently seen, general nervous relaxation and sedation are the most important points in therapy.

RATIONALE

It was felt that valuable information could be secured by fluoroscopic observations of the stomach and colon through the abdominal wall while they were under electric stimulation. The gastric study was included along with that of the colon, not primarily for the purpose of studying the effects of electric stimulation on gastric function itself, but rather on account of the ease and relative accuracy of observation of the effect of electric stimulation of smooth muscles, due to the unusually deep and regular peristaltic waves occurring in the stomach. In contrast to this regular gastric peristalsis, neither the mass movements nor the smaller fibrillary colonic peristalsis is often seen fluoroscopically. The colonic observations then were necessarily confined to:

(1) apparent tone, (2) movements of the colon, and (3) change of position of fecal material within the colon. The observed tone of the colon, of course, varies with the completeness of its filling, the position of the body, etc.

TECHNIC

For the experiments, a small group of doctors and experienced technicians was selected. Their familiarity with the equipment and the proposed experiment made it possible to rule out psychic effects. All of the stomachs were noted to be organically normal by preliminary barium meal.

The current used principally was a slow sine wave (8-a-minute) impressed on a 60 cycle alternating current of 20 volts and sufficient amperage in each case to produce strong physiologic contractions of the abdominal wall. Direct current with a surge of 8-per-minute was also used, although it was less efficient in producing contractions of the abdominal muscles. With both currents, a large electrode was used posteriorly at about the level of the diaphragm and a smaller one close to, but not directly over, the part to be stimulated. The equipment was one of the satisfactory low-voltage generators commonly employed. The voltage and amperage, of course, were not controllable independently of each other.

OBSERVATIONS

Stomach.—Electric stimulation over the stomach, using the technic previously described, failed to produce any consistent change in tone or peristalsis. At the time of contraction of the abdominal muscles, the cardia of the stomach became more nearly filled, due to the increased intra-abdominal pressure. At times the electric stimulation appeared to initiate peristalsis, but never in a specific or consistent manner. As much change in peristalsis is frequently noted after manual palpation. At other times, the

current appeared to inhibit peristalsis and to produce a tendency toward a spastic hyper-tonia. Smaller amounts of current were also used. With them there were fewer cases of inhibited peristalsis and there was even questionable improvement in peristalsis. Other variations of both alternating and direct current in common clinical use failed to produce any definite stimulation of gastric peristalsis.

Colon.—Twenty-four hours after the gastric examination, colonic stimulation was attempted with the above technic. The following observations were made: (1) Applications of the surging sine wave to the abdominal wall to the extent of producing strong contractions of the abdominal muscles gave rise to an alternately ascending and descending motion of the colonic flexures which was not distinguishable, except for differences in rate and timing, from the motion of the colon produced by deep diaphragmatic breathing. That this motion of the colon was not due to respiration was determined by coincident palpation of the abdomen and thorax. This movement of the colon was apparently due to stimulation of the diaphragm. (2) The alternate lengthening and shortening of the ascending and descending colon produced a slight suction effect within the colon, evidenced by the motion of particles of barium within the lumen. (3) The contraction of the abdominal muscles produced a certain massage effect on the colon. (4) The immediate effects on colonic tone and peristalsis were not definite, though there seemed to be at times a slight increase in tone.

CASE REPORTS

Case 1. J. W., male, aged 40 years. The history was essentially negative, except for "myalgia due to chronic tonsillitis." The blood pressure was 118/78. Urinalysis was negative, as was the routine blood examination, except for a white blood count of

10,500. Subsequently the patient has had tonsillectomy and complete dental extraction.

The patient was instructed to eat a moderate breakfast, as this would insure the most nearly normal functional condition of the upper gastro-intestinal tract. Preliminary examination after the administration of the usual barium meal showed the stomach to be moderate in size, regular in outline, and normal as to motility.

After this preliminary observation, 20 volts alternating current were applied with sufficient amperage to produce strong contractions of the abdominal muscles coincidentally with the peak of the surge (8-a-minute). The result was a slight decrease in the number and depth of the peristaltic waves in the stomach, which may have been in the nature of a clonic contraction, although the stomach was not noticeably smaller. The current was then changed from a "dwell" wave to a sine wave without improving results. The elimination of the wave failed to affect the peristalsis, which still remained somewhat subnormal. Small amounts of alternating current (insufficient to produce strong contractions of the abdominal muscles), both with and without surge, showed a slight improvement in peristalsis.

Twenty-four hours later, the barium-filled colon was treated with similar currents. In the areas of the transverse and descending colon, there was a tendency to express the fecal contents distally. At the time, this appeared to be due to increased intra-abdominal pressure at the instant of contraction of the muscles upon the intra-abdominal contents. This may have been due to the massage effect of the contracting abdominal muscles, as no intra-luminal fecal movement was noted in either the cecum or sigmoid. These two areas, of course, are protected by the skeleton from the direct effect of the contracting abdominal muscles.

At the peak of the surge, a paradoxical movement of the diaphragm was noted producing a descent of the colon with consequent shortening of the colon, while later, during relaxation of the abdominal muscles, the colon returned to a normal length. The paradoxical movement of the diaphragm was thought to be due to direct stimulation of the diaphragm itself, as ordinarily the diaphragm would be expected to rise with increased intra-abdominal pressure. The movement of the diaphragm and flexures differed only in rate and rhythm from deep abdominal respiration.

No definite changes in tone of the colon were noted.

Case 2. A male technician. The history and physical examination were negative. The blood pressure was 132/80. Wassermann, urine, and routine blood studies were negative.

The results were essentially the same as with the preceding patient.

Case 3. Miss W., female technician, aged 28 years. The history and physical examination were negative. Blood pressure was 130/80. Routine blood, urine, and Wassermann tests were negative.

As with the preceding patients the same experiment was carried out on the stomach. Owing to the sex and consequent weaker abdominal musculature, a larger amperage was necessary to produce palpable contractions of the abdominal muscles. In this case, there appeared to be some initiation of gastric peristalsis.

Twenty-four hours later the same currents were applied over the colon. The paradoxical motion of the colon was again noted, being most striking in the regions of the flexures.

Concomitantly with the alternate ascent and descent of the diaphragm, a slight to-and-fro movement of the barium was noted within the lumen of the colon.

Direct current, both with and without

surge, was less effective than alternating current in its effect on the abdominal muscles and on the smooth muscles of the colon.

Attempts to simulate by manual massage the colonic movements produced by electric stimulation were essentially unsuccessful, due partially to the fact that the flexures were guarded by the costal margins.

Case 4. Miss T., a female technician, aged 28 years. The history was negative, as was the physical examination, except for diagnoses of acne vulgaris, chronic tonsillitis, and secondary anemia. The urine was negative, as was the Wassermann. Routine blood examination was negative except for a hemoglobin content of 10.7 grams (68 per cent).

The observations were essentially the same as for Miss W.

Case 5. Miss S., a female technician, aged 35 years. There was a diagnosis of healed duodenal ulcer and chronic tonsillitis. Routine blood and urine examinations were negative.

Alternating current stimulations produced a questionable increase in gastric peristalsis. Similar results to those in Cases 3 and 4 were noted at the twenty-four-hour interval.

Case 6. Dr. Mc., a physician, aged 28 years. The history was negative except for a diagnosis of hay fever. The physical examination was negative. The blood pressure was 110/66. Routine blood and urine examinations were negative.

The patient is of asthmatic habitus, but good abdominal musculature was noted. The gastric stimulation failed to produce any changes in tone or peristalsis, though an ample movement of the colon was noted at the peak of the surge. The results were similar to those noted in previous tests.

CONCLUSIONS

1. Electric stimulation of the external abdominal muscles over the barium-filled stomach did not produce, during the time of fluoroscopic observation, any consistent or

specific changes in gastric tone or peristalsis.

2. Relatively large amounts of current seemed to decrease peristalsis, while smaller amounts of current seemed occasionally somewhat to increase gastric peristalsis.

3. Electric stimulation over the barium-filled colon produced the following changes:

- (a) Ascent and descent of colonic flexures and transverse colon, apparently due to diaphragmatic stimulation, producing a motion of the colon indistinguishable from that occurring in deep diaphragmatic respiration. This was not due to increase of intra-abdominal pressure as the movement was paradoxical, *i.e.*, the colon descended coincidentally with the contraction of the abdominal muscles.
 - (b) Secondary to this ascent and descent of the colon, an alternate lengthening and shortening of the colon occurred resulting in a to-and-fro movement of the colonic contents, more particularly in the region of the flexures. This, however, was not very striking.
 - (c) A certain amount of massage effect on the colon was noted, due to the strong contractions of the abdominal muscles.
4. The experiments emphasized the great value of electric stimulation in developing the abdominal muscles. This phase is still insufficiently used on patients for whom active exercise is not advisable and for those who fail to carry out exercise instructions.

5. These conclusions are based on the

immediate effects of electric stimulation of the gastro-intestinal tract and do not necessarily carry any implications as to the results obtainable in a series of treatments.

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EPITHELIOMA OF THE SKIN¹

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THE necessity for an early diagnosis is always stressed in discussions of malignancy. This is important in dealing with cutaneous epitheliomas as the probability of a cure depends to a great extent on the stage in which treatment is instituted. In the case of skin neoplasms, we have an undeniable advantage in that the pathology is on the surface and can readily be perceived by the patient. It is, therefore, frequently brought to the attention of his medical advisor in ample time to be cured. It is essential to recognize the nature of these growths readily and to know the conditions which are apt to develop malignant degeneration.

The essential cause of cancer is as yet unknown but a number of important factors have been investigated experimentally as well as clinically. The work of Maud Slye and others on the rôle of heredity has definitely established in mice the inheritance of a susceptibility to cancer. It is difficult in the case of human malignancy to determine the importance of heredity on account of the frequency of cancer, but heredity undoubtedly plays a part. The possibility of producing malignant lesions on the skin of certain animals by the use of an irritant such as tar has been demonstrated in a number of laboratories. In certain instances it is possible to establish the importance of external irritation in the development of human neoplasms. Well known examples are the "tar epitheliomas" which are seen in workers in soot or tar. Certain lesions of the lip and mouth are apparently due in part to the irritation of tobacco. Artificial ultra-violet light has been shown

to be a carcinogenic factor and this should make us hesitate to use such light in treating lesions of the skin which are apt to show cancerous changes. Individuals with sandy complexions (Fig. 4) are often the subjects of skin neoplasm, especially when they are exposed to chronic irritation, such as exposure to the sun and wind. Earlier writers often spoke of "farmer's cancer" and "sailor's cancer." These are simply cancers developing on a susceptible skin under the influence of the irritation of the elements to which men in these occupations are habitually exposed. It has often been noted that carcinoma is predominantly a disease of advancing age, and though many exceptions are encountered, nevertheless some change that occurs in the cells of the body as age advances predisposes to the development of malignancy. Keratoses are often spoken of as premalignant lesions. In the true sense of the word, this is not accurate. A certain number of them are probably malignant from their inception. We may safely conclude that the same causes predispose to non-malignant keratoses and to epitheliomas but there is no proof that keratoses become malignant. Warts rarely, if ever, show cancerous change. Xeroderma pigmentosum, a condition in which there is a congenital disturbance of the skin pigment, inevitably leads to the development of multiple skin neoplasms.

Pathologically and clinically there are two principal groups of skin malignancy: basal-cell epithelioma, or rodent ulcer, and the squamous-cell epithelioma. In addition, an intermediate type occurs in which clinical and pathologic features of both are seen.

The basal-cell epithelioma occurs in a number of clinical forms. It may develop

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Fig. 1. Basal-cell epithelioma.



Fig. 2. Basal-cell epithelioma.

as a cutaneous nodule with no tendency toward breaking down, or ulceration may occur early. The ulceration may be very superficial, with only a fine epitheliomatous border, or it may be quite deep. Another form occurs in which a cicatrizing tendency is seen and the lesion is a more or less smooth scar with a distinct rolled border. In all of these, the characteristic objective feature is the presence of a shiny, waxy appearance, either over the entire surface or at the borders. This waxy portion is traversed by tiny blood vessels and presents a very characteristic appearance. The most frequent location for this type of skin neoplasm is the middle third of the face but it may develop on other parts of the face and less often on the trunk or limbs. Although these growths are usually single, multiple lesions are by no means rare. Basal-cell epitheliomas are ordinarily very

slow in their development. This clinical point is often an aid in making a differential diagnosis and, though we are always apt to feel that the patient's observation may have been at fault, it should not be overlooked. This type of malignancy does not metastasize and owes its malignant character to the fact that it tends to invade and destroy the deeper tissues such as bone and cartilage, and to the fact that, if not completely removed, it recurs.

Pathologically the basal-cell epithelioma (Figs. 1 and 2) is made up of various sized groups of cells which tend to resemble those of the basal-cell layer of the epidermis, taking a deep stain with nuclear dyes. The cells are small and closely packed. At times cysts of various sizes are seen and these may be so numerous as to produce a clinical variety which is recognized as a cystic basal-cell epithelioma. In this type, which occurs



Fig. 3. Early carcinoma of the lip associated with keratoses.

most often at the canthi of the eyes, the opaque waxy appearance is replaced by a translucent appearance and fluctuation may be noted. This group is less malignant than the usual types but is more radioresistant and is rarely curable by radium or X-ray alone. The basal-cell epithelioma in general is noted as being relatively radiosensitive.

The squamous-cell epithelioma (Figs. 5, 6, and 7) is a much more malignant growth than the basal cell in that it is more rapid in its growth, usually metastasizes early, and is apt to be relatively radioresistant. This growth is seen in two well defined forms. The one is the everting (Fig. 7), in which there is a tendency for the growth to develop on the surface in mushroom form with a more or less well defined pedicle. The second is the indurating type (Fig. 6), which tends to diffuse extension. The first is slower in growth, later in metastasizing, and presents a more favorable prognosis than the second though there is a definite tendency for it to change into the indurating type. As with the basal-cell epitheliomas, the rate of growth is variable and the period at which metastases may be expected is not definite. In certain locations this type of growth presents special characteristics. Epitheliomas occurring on the external ear, though often clinically similar to basal-cell

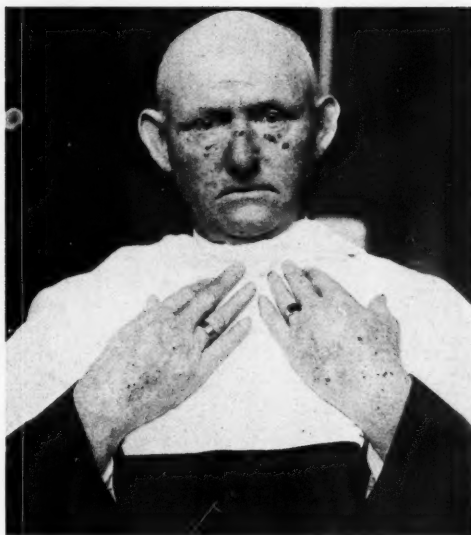


Fig. 4. Multiple keratoses with squamous-cell epitheliomas. Patient has a "sandy" complexion.

lesions, are practically all of the squamous-cell type but they are often slow in growth and late in metastasizing. Malignant lesions on the backs of the hands (Fig. 8) are predominantly of the squamous-cell type also, though they may at times resemble the basal-cell type in appearance. Here, too, the lesions are often of slow growth and late in presenting metastases. Carcinoma of the vermilion border of the lip (Fig. 3) is always squamous-cell in type.

Histologically the squamous-cell epithelioma is characterized by groups of cells which are of the prickle-cell type. Epithelial pearls, while more or less prominent as a rule, may be entirely absent. In general those growths in which the tendency toward keratotic pearls is slight or absent are the more malignant and at the same time more radiosensitive. This type of growth is usually diffuse and infiltrating microscopically, while the basal-cell growths are often fairly well limited.

Between the basal-cell and squamous-cell epitheliomas stands a group which has



Fig. 5. Early squamous-cell epithelioma.



Fig. 6. Squamous-cell epithelioma of the indurating type.

characteristics of both, clinically and pathologically. This mixed group has recently received considerable attention in this country. It is probable that from 10 to 12 per cent of the epitheliomas which we encounter belong to this group. It is not uncommon to see a lesion which has been diagnosed as a basal-cell carcinoma, in spite of the history of relatively rapid growth, which is apparently cured by radiotherapy but recurs early. In the course of subsequent treatment, a biopsy is done which reveals in some areas the pathology of a basal-cell epithelioma and in others that of a squamous-cell epithelioma.

In the treatment of epithelioma of the skin, certain principles are applicable to all types in whatever location they are found. No one method of therapy should be considered routine; the means should be varied to meet the circumstances. The treatment employed must be adequate to destroy com-

pletely the lesion to its furthest extent. Incomplete destruction is worse than useless in that it increases the resistance to further treatment by stimulating the growth to further extension and by producing fibrosis which tends to protect the cancer cells from destructive measures. The danger of removing a specimen for microscopical examination has been overstressed. The cosmetic effect is, of course, a secondary matter but should be given due consideration when possible.

Radiotherapy either in the form of X-ray or radium may be used alone or in combination with other forms of therapy. In recent years we have reserved radium therapy without other supplementary means for lesions, such as those of the eyelids, in which it is important to obtain the least possible destruction of uninvolved tissue. For such lesions, either X-ray or radium may be used, but an effective dose should be given

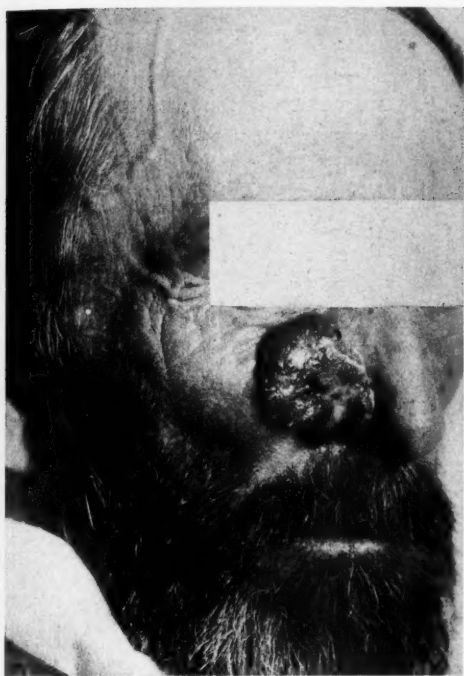


Fig. 7. Squamous-cell epithelioma of the everted type.



Fig. 8. Squamous-cell epithelioma of the hand.

within the shortest possible time. We have had but little experience with X-ray and have used radium or radon exclusively. The dose used varies with the size and apparent extent of the lesion but is usually given with tubes screened with 0.5 mm. of silver and 1.0 mm. of rubber, the dose being from 40 to 60 mc.-hrs. per tube, allowing one tube for each square centimeter of surface to be radiated. Where there is no contra-indication, we prefer to curet the lesion under novocaine anesthesia, cauterizing the base by electrodesiccation or with the actual cautery. This is usually augmented, especially in the case of squamous-cell lesions, by the application of radon tubes screened as above, giving from 20 to 40 mc.-hrs. per tube. Lesions that have been unsuccessfully radiated previously are rarely again treated by radiation. For many of these, radical surgery with plastic repair is the treatment of choice

if a complete removal is practicable, even though considerable deformity is unavoidable. Epithelioma of the ear is preferably a surgical problem and should be excised by the cautery knife, cutting current, or by sharp dissection. Radiotherapy is contra-indicated on account of the danger of producing a slow healing ulcerative reaction in the cartilage, when adequate dosage is given. Epithelioma of the hand is usually best removed surgically on account of the more rapid healing and because the ensuing scar is less marked than by other means. Epithelioma of the lip is best removed surgically in many instances, though an equal number of cures can be obtained by radium therapy alone or combined with curettage and desiccation. Radiotherapy is particularly indicated in those cases in which there is an extensive cheilitis and the lesion is apparently superficial. In the case of squamous-

cell epithelioma in general the possibility of metastases to the regional lymph nodes must be borne in mind and watched for, but our experience has convinced us that surgical removal of menaced lymph chains which are not clinically involved is not advisable. The value of radiation to these areas as a prophylactic measure is still undecided. We prefer to treat the glands conservatively, watching for clinical evidence of involvement before instituting treatment. Whenever practicable, clinically involved lymph nodes should be removed surgically with the entire lymph chain. If they are inoperable they are treated by the insertion of gold seeds of radon either through the skin or with the aid of surgical exposure. This may be augmented by external deep X-radiation. At times the improvement is sufficient to enable the surgeon to do a complete operation at a later date.

CONCLUSION

We wish to emphasize the importance of the early diagnosis of epithelioma of the

skin. That certain individuals, especially those of sandy complexion, are more susceptible to the development of skin neoplasms must be borne in mind. If radiotherapy is to be made use of, it is desirable to give an adequate dose at the start, for resort should rarely be had to repeated radiation.

DISCUSSION

DR. H. J. ULLMANN (Santa Barbara, Calif.): Within the last month and a half I have treated a man with a squamous epithelioma of the helix of the ear and a basal-cell epithelioma of the upper lip, just above the vermilion border. I have been treating carcinomas of the ear, such as were shown, with the roentgen ray. While I am willing to admit that they heal rather slowly, so far they have healed successfully, and I prefer to treat them with the roentgen ray first, because, while the cartilage is slow in healing, it does heal and it saves removing a large section of the ear. For this reason, the cosmetic results are better.

LAY ENCROACHMENT UPON RADIOLOGY: ITS MEDICO-LEGAL ASPECTS

By CARL SCHEFFEL, M.D., LL.B., MIAMI, FLORIDA

Author of "Medical Jurisprudence" and "Jurisprudence for Nurses"

THE fact cannot be escaped that medical practice is being encroached upon more and more—almost daily—from varying angles. Radiologists have by no means escaped such encroachment; yet at the same time it would be unfair to allege that the laymen thus intruding upon various branches of medicine are by any means all to blame. Indeed, we should not belittle the truth that not a few of our own brother-physicians are not only making encroachment by laymen in the field of radiology possible, but are the very means whereby it is kept alive and on the increase.

In the following paragraphs only an outline of some of the medico-legal aspects of this situation will be considered from both a preventive and remedial point of view.

The first question that requires answering is: "Who and what are so-called technicians and other laymen who generally encroach upon the field of radiology?" A search of the laws pertaining to the various branches of the healing art will disclose, I believe, that there exists not a single statute anywhere by virtue of which a so-called "technician" (X-ray or otherwise) is legally specifically recognized as such, or is authorized to practise. In other words, X-ray "technicians," as such, have no special legal standing as independent contractors authorized by law as are registered nurses, cultists, and others engaged in some branch of the healing arts by virtue of legal recognition.

On the other hand, it must be admitted, unfortunately, that in some States laws do exist that give persons, who may, among other things, call themselves "technicians," the right to perform acts which, from the

scientific standpoint, are considered as rightly belonging to some branch of medicine. True, these laws give laymen that right, indirectly and by implication, but they legalize their activities none the less.

By way of illustration: Osteopaths, chiropractors, and even naturopaths, have, in some States, succeeded in having special licensing acts passed that give them the legal right to take roentgenograms and use the X-rays therapeutically. Manifestly, such individuals, if cultism no longer appears profitable, have the right to drop their cultist affiliations and call themselves "technicians." Certainly, do not many of our brother-physicians "fall for" that term, whereas they would shun chiropractors or naturopaths? Moreover, for the cultists, it forms an easy way to enter real medical fields by back-door methods, a practice which seems to be encouraged by a certain type of physician.

Then, too, many of our so-called "medical practice acts" so abstractly define what is deemed to come within the meaning of the practice of medicine that even "technicians," with no special legal recognition of any nature, may lawfully hold themselves out as conducting X-ray laboratories. I know of no State whose medical practice act is so concretely worded that the exposure of a patient to the dangers of the X-ray for the purpose of making a film would constitute an act coming within its logical interpretation to the extent that criminal prosecution for its violation could be obtained. As a matter of fact, in a few States, hairdressers and cosmeticians are using the X-rays for therapeutic purposes without apparently coming into conflict with the

medical practice laws, or those responsible for their enforcement! True, every now and then, our medical journals publish case reports of the damage done by such misuse of medical encroachment, but do we hear a word about making such practices impossible? Not much—the powers that be seem to be too busily engaged in shadow-boxing with imaginary evils in our own ranks.

Certainly, under existing conditions in this connection, the time seems not so far distant when radiology will fall into the hands of the laity, working under the guise of “technicians,” much as the practice of electrotherapy has done, and other forms of physical therapy are doing. And the only way to remedy the situation, so far as the laymen’s aspect of such encroachment is concerned, is to enact medical practice laws with specific and concrete terminology, and then have them enforced by men with backbones instead of wishbones.

When, however, we view our brethren within the medical profession who make possible the continuance of such lay encroachment in the field of radiology by sending patients to such “technicians,” then we become awe-stricken at the risks thereby assumed from a medico-legal standpoint. As already outlined, unless a so-called “technician” or other lay operator of an X-ray laboratory operates under the protecting wing of some special cult or other license which gives him some legal status as an independent contractor, or unless he is given implied legal authority to take roentgenograms or give X-ray treatments by virtue of loopholes in the medical practice laws, then he has no legal right to independently handle X-rays for any purposes.

Obviously, a physician sending a patient to be X-rayed by a “technician” in legal “no-man’s land,” as it were, who, of his own accord, has no legal right to take X-ray films, then delegates to that “technician” some of the authority given him by virtue of

his own license to practise medicine. This, in law, constitutes the creation of an implied relationship of principal and agent, in which the physician becomes the principal, and the “technician” becomes his agent. Viewed in any other legal light, the “technician,” not having lawful authority to do X-ray work as an independent contractor, must perform his acts either as an agent of one who has that right by virtue of special license, or the physician under the circumstances must be conspiring with an unlicensed person to violate the medical practice laws when he sends a patient to a “technician” who is of *status nolo*. Of course, in law, it is always presumed that a person is acting outside the pale of criminal intent or attempt in any situation in which an act can be construed as either criminal or non-criminal. So far as this legal axiom applies to physicians sending patients to “technicians,” who have no independent legal status as practitioners, it simply brings them, by preference, within the jurisdiction of the laws of principal and agent by implication.

While physicians almost daily create implied relationships of principal and agent in connection with assistants of various kinds, both professional and lay, there exists grave doubt as to whether or not physicians appreciate to the extent that they should the responsibilities that arise out of such a relationship.

With extremely rare exceptions, a principal becomes responsible in law for any wrongdoings of his authorized agents. So far as physicians are concerned who send patients to “technicians” who have no status as independent contractors, if the patients are injured by such “technician”-agents, then the referring physician, as the principal, may become liable for damages the patient incurs as the result of being referred by the physician. If more physicians would appreciate the risks they are taking when sending patients to so-called X-ray laboratories

conducted by those holding no special license which gives them legal recognition, they would think twice before sending their patients to such outfits.

Then, too, the medical examining boards of many States have the authority to make rules governing the conduct of physicians which they construe as being proper conduct. Among the acts which have been construed as constituting unprofessional conduct for which medical licenses may be revoked or suspended has been that of aiding and abetting an unlicensed practitioner—and what else is a physician doing when he sends patients to an unlicensed lay "technician"? It is believed that a few vigorous prosecutions under this inherent power possessed by most medical examining boards,

would greatly mitigate lay encroachment upon radiology in any given community.

SUMMARY

Lay encroachment upon radiology is possible from two causes: First, existing so-called medical practice laws are too ambiguous, too unspecific, and contain too many loopholes; second, physicians, by sending patients to such laymen, make possible the continuance of such encroachments—to be sure, at some risk to themselves as implied principals becoming liable for the wrongful acts of such laymen.

Last, but not least, the continuance and growth of such encroachment is chiefly possible because physicians deliberately—and unchallenged—aid and abet unlicensed persons in practice.

CORPORATIONS PRACTISING LAW OR MEDICINE

By I. S. TROSTLER, M.D., F.A.C.R., F.A.C.P., CHICAGO

THE legal profession have, long ago, made provisions against corporations practising law, by having enactments incorporated into the statutes of practically every State in the Union (if not all); but so far, search has resulted in our being unable to find any such specific legislation relative to the practice of medicine by corporations.

But even in the absence of specific legislative and statutory provisions forbidding this, there has accumulated quite a considerable number of very satisfactory legal decisions which have practically become the "law of the land," and in the securing of several of which the writer took an active part.

Licensure to practise medicine is required in all of our States, and as these licenses are granted to individuals only and not to firms, groups, or corporations, the presumption by the courts of last resort has been that, not

being licensed to practise medicine, naturally they did not have the right to do so. Of course, attorneys presented the arguments to the trial and appellate courts which led to these decisions—but the decisions were rendered and, when called to the attention of courts, should go far toward securing satisfactory verdicts that *corporations cannot practise medicine*.

The following are among the most recognized and acknowledged cases and references:

State Electro-medical Institute *vs.* State (Neb.), 103 N.W.R. 1078, 1079.

State Electro-medical Institute *vs.* Platner (Neb.), 103 N.W.R. 1081, 1082.

State *vs.* Lewin (Mo. App.), 106 S.W.R. 581-583.

Pilger *vs.* City of Paris Dry Goods Co., 86 Calif. App. R. 281.

Underwood *vs.* Scott (Kansas), 23 Pac. R. 942.

In re Co-operative Law (N. Y.), 92 N.E.R. 15-17.

People *vs.* Painless Parker (Colo.), 275 Pac. R. 928-930.

Brown *vs.* La Société Française, 138 Calif. R. 475-478.

People *vs.* Woodbury Dermatological Institute, 192 N. Y. 454, 85 N.E.R. 697.

Hannon *vs.* Siegel, Cooper & Co., 167 N. Y. 244; 60 N.E.R. 597; 52 L.R.A. 429.

People *ex rel.* Lederman *vs.* Warden of City Prison, 168 App. Div. 240; 152 N. Y. Supp. 977.

Godfrey *vs.* Medical Society of New York, 164 N. Y. Supp. 846, 850, 851.

(1) Fletcher Encyclopedia of Corporations, page 253.

(3) Cook on Corporations, 8th Edition, Sec. 681, page 2682.

(14) Corpus Juris, Sec. 2145, pp. 296-298.

RESPONDEAT SUPERIOR

Two Unusual Decisions.—As a general thing, the doctrine of *respondeat superior* (the master is responsible) has been held *not to apply* in the relation of physicians and their employers, because in the nature of the physician's duties, his employer cannot direct his conduct or lay down definite instructions relative to his acts and, therefore, the relation of master and servant cannot legally exist when applied to employers and physicians practising medicine.

But—like many other legal questions—there are exceptions, and among these: "*Respondeat Superior*" holds for physicians (*in malpractice cases*) in Brown *vs.* La Société Française, 138 Calif. R. 475-478, and in Bowman *vs.* Southern Pacific Co., 55 Calif. App. 734, 740.

REPORTS OF CASES¹

Court Affirms Damages for a Roentgen Injury (When Filter was Forgotten): (Legler *vs.* Muscatine Clinic et al. (Iowa), 223 N.W.R. 405).—The plaintiff was injured in the course of treatment with roentgen rays. A verdict and judgment were given in his favor for \$20,000. The defendant appealed to the Supreme Court of Iowa, which affirmed the judgment.

After the removal of one of the plaintiff's testicles because of an adenocarcinoma or embryonic carcinoma of the seminal tubule, a primary carcinoma or cancer of the testicle, roentgen treatments were administered to prevent recurrence. When the fourth or last treatment, Jan. 25, 1927, was administered, a filter was not put in the machine. Its omission was discovered immediately after the treatment, and the patient was informed that he would have a burn. Everything possible was done to counteract the effect of the treatment thus improperly administered, but a semi-elliptic burn developed on the left side of the patient's spine, approximately 10 inches long and 4½ inches wide. Various operations were performed to cure it, but at the time of the trial, Feb. 29, 1928, a part of the burned area remained unhealed and expert testimony showed that it was uncertain how long it would remain so. The plaintiff, a farmer and stock raiser, was 42 years old, with an expectancy of life, according to the life tables, of 26 years. Some of the experts testified, however, that there was likely to be a recurrence of the cancer within from five to seven years and that a recurrence of cancer of the type from which the plaintiff had suffered is usually fatal. At the time of the trial, the plaintiff could bend his body at the hips about 15 degrees from the perpendicular. His inefficiency resulting from

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the burn was variously estimated at from 30 per cent to 50 per cent. Even if the wound should heal, there would be marked permanent disability during the remainder of the plaintiff's life. He had suffered excruciating pain and would continue to do so for some time. He had expended for medical treatment, nurses' hire, and hospital bills, approximately \$3,000. Prior to his injury, his time in connection with his business was estimated, without dispute, to be worth \$2,500 a year. From all the facts and circumstances, the Supreme Court did not feel that the amount of the verdict, \$20,000, was excessive. There was no error in the record prejudicial to the appellant. The judgment of the court below was, therefore, affirmed.

Roentgen Injuries and the Presumption of Negligence (Res ipsa loquitur applied in Diagnostic Case Injury): (Moore vs. Steen (Calif.), 283 P.R. 833).—The defendants, as physicians, were employed by the plaintiff to find out what was ailing him. In the course of their examinations, the plaintiff suffered a third degree roentgen burn. He brought suit, alleging carelessness and unskillfulness on the part of the physicians. At the close of his evidence, the court, on motion of the defendants, dismissed the case. The plaintiff thereupon appealed to the District Court of Appeals of the Fourth District of California.

The only element of proof, said the Appellate Court, that is subject, in this case, to a question as to its sufficiency, is the evidence to prove that the injury sustained was owing to the defendants' negligence; unless the doctrine of *res ipsa loquitur* applies, the evidence of negligence is extremely meager and depends upon the process of elimination. The evidence showed three possible causes for the patient's injury: first, negligent and dangerous excess of electric current in the roentgen apparatus; sec-

ond, hypersensitiveness of the patient, unknown to the defendants; third, latent defects in the roentgen apparatus, or dispersion of the secondary rays in its operation. The evidence showed that the patient was not hypersensitive. The defendants argued that, although the evidence excluded hypersensitiveness, it showed that the burn could have resulted from two possible causes, either negligence or unskillfulness in the operation of the roentgen-ray apparatus or hidden defects in that apparatus, and they pointed out that the evidence adduced by the patient did not exclude hidden defects in the apparatus as the cause of the burn. But, said the Appellate Court, we doubt if the burden of eliminating that possible explanation of the patient's injury can be thrown on the patient. The apparatus used had been long in the possession of the defendants; if it possessed latent defects, its power for evil would have developed before this patient was treated. On the other hand, the patient himself could have no possible previous knowledge nor means of discovering secret and undisclosed possibilities of the apparatus. It would seem no more than reasonable, therefore, that the doctrine of *res ipsa loquitur* should apply, at least to the extent of throwing the burden of proof on the defendants to show the existence of some faulty condition in the apparatus, that was beyond their knowledge or control and that would relieve them of the implication of negligence in its operation.

The weight of authority in recent decisions in other jurisdictions is against the general application of the doctrine of *res ipsa loquitur* to the use of the roentgen ray, and ordinarily the doctrine cannot be applied in cases of alleged malpractice by physicians in the treatment of disease. It is to be noted, however, that the present case is not based on the treatment of disease, but on diagnosis. A distinction between the use of roentgen ray for treatment and its

use for diagnosis is recognized in the decisions, the reason for which is pointed out in *Ewing vs. Goode* (C.C.), 78 F.R. 442, 443. The Supreme Court of California, in *Ragin vs. Zimmerman* (Calif. Supp.), 276 P.R. 107, a personal injury case based on the diagnostic use of the roentgen ray, held that the doctrine of *res ipsa loquitur* might properly be applied. The Court of Appeals, therefore, in the present case, held that the injuries to the patient could not be attributed to latent and undiscovered defects in the roentgen apparatus, but was caused by the negligence of the defendants. In any event, said the court, the case was one for the application of the doctrine of *res ipsa loquitur*.

The judgment of the trial court in favor of the physician-defendants was reversed.

Failure to Use X-rays in Eye Case is Negligence (*Lippold vs. Kidd* (Ore.), 269 P.R. 210).—The plaintiff suffered an injury to his eye, Jan. 31, 1924. He employed the defendant, an eye specialist, to attend the injury. The defendant made an examination and found only a small foreign particle, which he removed. He bandaged the eye and subsequently gave the plaintiff six or seven treatments. He then instructed the plaintiff to return if he experienced further pain or trouble with his eye. The plaintiff did not return, but seven months later, August 30, he consulted Dr. W. and Dr. B., who discovered a sliver of steel in the eye. They were unable to withdraw the sliver with a magnet and several days later they removed the eyeball. The plaintiff sued the defendant, alleging negligence, and from an adverse judgment in the Circuit Court, the defendant appealed to the Supreme Court of Oregon. The defendant contended that much of the testimony on which the plaintiff predicated his charge of negligence was inadmissible. The crux of the case, the court said, was what constituted ordinary

care as determined by the facts as they appeared to an eye specialist on January 31, the date when the defendant first saw the plaintiff. In lieu of that, the witnesses for the plaintiff were permitted to testify with respect to the situation as of August 30. There was no testimony that, under the circumstances as they appeared to the defendant January 31, the treatment fell short of the established standard. The expert witnesses for the plaintiff based their conclusions on their personal knowledge, their treatment of the plaintiff, the operation on the eye, what they observed when it was dissected, and the evidence they heard in the court room. The answers of these experts were insufficient to establish negligence because the only premise with which they were familiar was that of August 30. If they undertook to base their conclusions on the facts as they existed on January 31, the question should have supplied the premise in hypothetical form.

The evidence tended to show that the defendant made no roentgenogram of the plaintiff's eye. The plaintiff testified that the defendant failed to make an examination of the interior of his eye with an ophthalmoscope. The foregoing facts, the court said, established a *prima facie* case of negligence. Negligence alone, however, is insufficient to establish liability. The evidence must show that such negligence was the proximate cause of the injury. Dr. F. testified that, when any foreign particle becomes impacted in the retina, sooner or later the retina becomes detached and the victim loses the sight of the eye, and that a piece of steel which penetrates the eyeball with sufficient force to embed itself in the posterior part of the eye eventually causes a shrunken eyeball and necessitates its removal. The same witness testified: "Not a foreign body that penetrates the eyeball completely, when it lodges in the posterior sclera or retinal region, that doesn't materially

change the pathology of the eye, whether you remove it then or later. It has done its work going through; it has done its damage. . . . No foreign body can be impacted in the retina and removed and leave perfect eyesight; you will have a chronic inflammation and loss of sight gradually, with detached retina."

As against this testimony, Dr. W., an expert for the plaintiff, testified as follows: "A small piece of detached retina, if not in the direct line of vision, would not necessarily destroy the vision. Many people have portions of retina detached for many years without affecting their direct vision—central vision."

In answer to a question as to whether or not, if the particle had been promptly removed, chronic inflammation would have resulted and loss of eyesight gradually increased, Dr. W. answered that it might and might not. Before the plaintiff could recover for the injury to his eye, the court said, it was necessary that he should be possessed of an eye that a physician could rehabilitate. If the eye was already damaged beyond repair, he suffered no ill effects from the defendant's negligence. From the evidence submitted in the case, the Supreme Court could not see that when the plaintiff consulted the defendant his left eye was susceptible to rehabilitation. The court held, therefore, that the plaintiff failed to prove that the defendant's negligence was the proximate cause of the removal of the eye and reversed the judgment of the lower court and instructed that court to enter judgment for the defendant.

*What Expert Testimony should Do: (City of Kingfisher et al. vs. State Industrial Com. et al. (Okla.), 242 Pac.R. 217).—*Expert testimony should serve the purpose of making clear to the ordinary mind facts that are obscure and understood only by scientific study, skill, and experience, and

such testimony should be definite and certain and explanatory of the point under consideration.

*Failure to Provide against Swallowing of Radium Capsule is Malpractice (Jacobs vs. Grigsby et al. (Wis.), 205 N.W.R. 394).—*A silver capsule, containing radium, used in the nose, slipped into the nasopharynx and was swallowed by the patient. Immediate gastrotomy was done. Verdict for the plaintiff for \$3,000 because the string attached to the capsule was not long enough was confirmed by the Wisconsin Supreme Court.

*Roentgenograms (or Anything) may be Used to Refresh Recollection: Henkelman vs. Pastebrick (N. J.), 130 Atl.R. 441).—*Physician's witness may examine roentgenograms to refresh his memory even though they (the roentgenograms) are unidentified and not introduced as evidence. Anything that will refresh the recollection of a witness may be looked at by him for that purpose, although in itself it is not evidential.

*Wealth of Patient and Physicians' Fees (Houda vs. McDonald (Wash.), 294 P.R. 249).—*For several years, Mrs. McDonald had been seriously afflicted with goiter. She had had much treatment, including a surgical operation. In the Fall of 1928 she consulted the plaintiff, Dr. Houda, and after several months' treatment was operated on by him, apparently with satisfactory results. Mrs. McDonald and her husband owned community property worth \$1,600,000, for the most part income-producing property. Dr. Houda had no express agreement with either the patient or her husband as to what he would charge for his services. The husband died in July, 1929, and thereafter Dr. Houda presented to Mrs. McDonald, his patient, who had been qualified as executrix of her husband's estate, a bill for \$15,000.

In fixing his charge, he took into consideration the wealth of his patient and her husband, the importance of the service to her, and the skill required in rendering that service. As executrix, Mrs. McDonald refused to approve the bill for the amount stated, but did approve it for \$1,000. Dr. Houda thereupon instituted suit to recover the entire amount claimed. In the superior court for Pierce County, a jury returned a verdict in his favor of \$3,500, and judgment was rendered accordingly. Mrs. McDonald thereupon appealed to the Supreme Court of Washington.

The decision of the Supreme Court turned on the admissibility of evidence as to the wealth of the patient and her husband, for the purpose of proving the value of Dr. Houda's service. Evidence as to the wealth of Mr. and Mrs. McDonald and the testimony of three physicians proffered as witnesses by Dr. Houda were admitted over the objection of counsel for Mrs. McDonald. On behalf of Dr. Houda, a physician testified that it was the general practice of physicians and surgeons in the community and in the State of Washington to take into consideration the financial status of patients in determining the charge to be made for professional services. A bill for a major operation, said this witness, would represent about 10 per cent of the annual income of the person liable for payment. The fee demanded in the present case, \$15,000, he thought, was just. Another physician testified that it was the custom of physicians to fix their charges on the basis of the incomes of their patients; with some physicians it was the practice to charge a month's income for major operations, and others charged 10 per cent of the yearly income for such operations. This witness professed to be fairly familiar with the general practice throughout the United States and so far as he knew it is the universal custom to take into consideration the wealth of the patient in fix-

ing charges for a physician's service. He regarded the fee demanded in this case as reasonable and proper. A third physician, appearing on behalf of Dr. Houda, concurred substantially in the testimony of the two preceding witnesses. Two physicians offered as witnesses on behalf of Mrs. McDonald agreed that it was customary for physicians to take into consideration the financial ability of patients to pay, in fixing the charges to be made for professional services. One testified that for an ordinary goiter operation and the ordinary treatment that precedes and follows such an operation, a charge of from \$500 to \$1,000 to a man reputed to be a millionaire would represent a large fee. The other physician, testifying on behalf of Mrs. McDonald, was of the opinion that the ordinary charge for goiter operations in the community was from \$150 up. He, himself, applied the 10 per cent basis of charges with respect to most major operations, up to a certain limit. For services rendered by Dr. Houda, he considered \$1,000 a good fee.

These five physicians, said the Supreme Court, agreed that the wealth and income of a patient is customarily considered as an element controlling, in some measure, the reasonable amount of compensation a physician is entitled to for services of the nature involved in the present case. In this particular case, however, there were several estimates of the reasonable value of the services rendered, ranging from \$500 to \$15,000. There seems to be a lack of harmony in the decisions of the courts concerning the admissibility of evidence of the pecuniary circumstances of the person liable for compensation for medical and surgical services rendered. We are of the opinion, said the court, that the rule best supported by reason—in any event as applicable to this case—is that in some substantial measure the reasonable compensation of a physician is determinable by the ability of the patient or

her husband to pay for the service. The contract for the service was made by the physician directly with the patient who was to benefit by his services, including a major operation, and it was shown by competent evidence that it is customary among physicians to charge for such service in some measure according to the ability of the patient to pay. If wealth and income of a patient are admissible facts to be proved in a controversy of this nature, then the evidence of the wealth of the patient and her husband and the testimony of physicians were admissible to be considered by the jury and manifestly support the verdict and judgment awarded to Dr. Houda for recovery in the sum of \$3,500. Judgment of the court below was affirmed.

Interpretation of Roentgenograms by Chiropractor (Ness vs. Yeomans (N. D.), 234 N.W.R. 75).—The plaintiff fractured the ulna of his right arm. The defendant, a physician, was employed to treat the injury. In this action, the plaintiff alleged that the fracture was not properly reduced and that proper after-treatment was not given. The jury rendered a verdict for the plaintiff and, after the trial court had denied a motion for a new trial, the defendant appealed to the Supreme Court of North Dakota.

The defendant contended, among other things, that the trial court erred in permitting a chiropractor to testify with respect to certain roentgenograms which he, the chiropractor, had taken of the plaintiff's arm. The witness testified that he had had six years' experience in roentgenography. There was no error, said the Supreme Court, in permitting the witness to testify. The fact that he was a chiropractor was a mere incident, except so far as it showed his knowledge and study of human anatomy. The names, number, and position of the bones in the human body are the same, whether

one is a regular physician or a chiropractor. It is not the school which he follows, but his knowledge, experience, and special training which qualify a witness to testify. A chiropractor may testify as to matters in which he is qualified to speak so long as he does not attempt to testify in regard to a school of treatment separate and distinct from his own. If the witness has studied human anatomy so as to acquire special knowledge, if he knows how to take roentgenograms so as to give correct representations, if he knows how to read and interpret them, then he is qualified to testify.

While the evidence seemed to show, said the court, that a perfect union had not resulted, all the expert witnesses testified that the union was a good one and that the treatment given by the defendant-physician was proper treatment. The stiffness of muscles and the loss of motion, about which the plaintiff complained, could not be attributed, in the opinion of the witnesses, to any negligent treatment given by the defendant, but to the plaintiff's failure to follow instructions as to exercise of the arm and fingers. The defendant used a fluoroscope in reducing the fracture, but the plaintiff contended that the defendant should have made a roentgenogram of the arm after the fracture had been reduced to determine whether the bones were in apposition. Had such an examination been made, contended the plaintiff, the fact that one portion of the broken bone projected past the other would have been detected and could have been remedied. Even if this were so, said the court, all the expert testimony in the case showed a good union and that correct practice was followed. The contention here made by the plaintiff involved a question of good practice and on this question the expert testimony controls.

The defendant is not responsible for the result of his treatment, said the court, unless the result is caused by his negligence.

There was nothing shown in the case which was not consistent with good practice; neither was there anything in good practice which the defendant did not do. The burden of proof is on the plaintiff to show that the proper method was not employed, that the proper treatment was not given, and that the physician violated some of the rules of good practice, so that the result complained of necessarily came from such violation. This the plaintiff failed to do. The Supreme Court, therefore, reversed the order of the trial court denying a new trial and remanded the case.

Compensation of Physicians: Liability for Services Rendered Daughter (Ineeda Laundry vs. Newton (Texas), 33 S.W.R. (2d), 208).—The appellee was injured by the appellant's truck. At her father's request, a physician rendered necessary medical services. The fact that such services were rendered at the request of the father and that the physician charged them to the father did not relieve the daughter from liability for the value thereof. The services were rendered for her benefit and she was entitled to recover from the appellant the amount of the physician's charges.

VIENNA CLINICS

(Continued from November, 1931, p. 1048.)

DISCUSSION

DR. BORAK (closing remarks): With regard to the statements of Professor Adler, I wish to state that the "laws" of hereditary transmission are equally valid for all living creatures but that the conditions under which they become manifest may vary exceedingly in different species of animals; yes, sometimes in different varieties within the same species. In mammals and in man the conditions are such that in them (at least in the female sex) mutations cannot be elicited by roentgen irradiation if it is true that this irradiation effect is first manifested in the mature germinal cell, as appears to be proved by suitable experiments. The fact that in female mammals a zygotic and in *Drosophila* a gametic reduction occurs, as the difference can be briefly formulated, is the reason why in female mammals only a damage to the fetus and no damage to the germinal cell is possible as the result of roentgen irradiation. Since the mutability following roentgen irradiations goes hand in hand with the spontaneous mutations and the latter vary greatly in different species of animals, the appearance of mutations in mammals is for that reason scarcely to be expected. That is the result reached by me in my observations. My colleague, Dr. Peller, analyzed the situation on the basis of the assumption that my deductions were incorrect; namely, that also in mammals and in man mutations may in reality be produced by roentgen irradiations. By introducing two absolutely unquestionable facts, namely, the absence of inbreeding and the small number of descendants in man, Dr. Peller furnished a mathematical demonstration that the probability of effecting hereditary injuries by irradiations applied to the

ovaries is so extremely slight that it does not need to be practically considered. His computations were not made upon an optimistic basis but rather on the assumption of the most unfavorable presuppositions. For instance, Dr. Peller intentionally avoided taking into account the reduced fertility of women that are subjected to ovarian irradiation (ascribable to the fact that most of such patients are affected with anomalies of menstruation or with tumors of the adnexa), because the influence of this factor could not be expressed in figures. In other words, the consideration of the inner conditions under which the "laws" of hereditary transmission may become manifest shows the impossibility of hereditary injuries being caused by irradiation of the germinal glands in mammals and in man, at least in the female sex. The consideration of the external conditions under which the "laws" of hereditary transmission may become manifest shows the bare possibility of injuries resulting, which, however, viewed mathematically is practically negligible.

As for the second statement of Professor Adler, that early injuries have been observed after irradiations, it will be recalled that I have already called attention to the fact that that is regularly the case in the lower animals such as frogs, flies, and wasps. On the other hand, after roentgen irradiation of various species of mammals, such as rabbits, guinea pigs and mice, early injuries have not been observed. My foregoing discussions were for the purpose of explaining this differential behavior. Late injuries, that is to say, hereditary, biologic changes after irradiation of immature germinal cells have not, however, been observed in any animal species. Many authors who reported anomalies in the first filial generation of ir-

radiated animals—for example, a reduced number of offspring and a reduced body weight—overlooked an important source of error that lay in the fact that, because of the functional dependence of the uterus on the ovaries, through the irradiation of the ovaries the uterus will be secondarily affected through sympathy. Many so-called injuries of the gonads, if they are not absolutely pronounced injuries of the fetus, may be ascribed to such injuries of the uterus. The increased frequency of miscarriages in irradiated women comes likewise under this head. This is proved by the fact that such manifestations do not appear when the male gonad is irradiated, and even after the irradiation of female gonads they appear only in the first litter following the irradiation, whereas in the following litters, after the uterus has recovered from the temporary exclusion of the ovaries, they no longer occur.

In connection with the instructive remarks of Privatdozent Moszkowicz, I wish to state that in *Drosophila* similar irradiation effects were produced only in part. Hanson, Muller, and Timoseff-Reschowsky irradiated anew mutations that developed after roentgen irradiation and thus obtained in a large proportion of the cases retrogenovariations; that is to say, retrogression to the original type. From this observation it becomes evident that the consequences of the irradiation do not concern mutations with absolute loss of hereditary characters and that the changes brought about by the irradiation are of an entirely reversible nature.

With regard to the statements of Dr. Quastler, let me call attention to the numerous researches of American investigators in the field of hereditary biology, who unanimously agree that the spontaneous and the roentgen mutations are absolutely identical in their nature. Owing to the rarity with which the spontaneous mutations appear, it

is, however, quite conceivable that one or the other mutation appearing after roentgen irradiations has never been previously observed as a spontaneous manifestation. The quantities of rays employed to secure hereditary, biologic effects are, indeed, extremely large; that is, if taken in an absolute sense. Considered relatively, that is, in comparison with the ray tolerance of *Drosophila*, they are not so large; for they constitute only a part of the amount of rays that destroy the vitality of *Drosophila*. It is, however, true that the doses employed for the securing of hereditary, biologic irradiation effects exert a sterilizing effect on a large portion of the flies, as the authors emphasize in common agreement. An analysis under dosimetric points of view, especially on the basis of the sterilization doses applicable to *Drosophila* and to mammals, and possibly in man, would doubtless lead to exceedingly illuminative results, but, aside from other difficulties, it is hardly possible with present facilities to carry it out, if for no other reason, because of the inexact nature of the dosimetric records in the *Drosophila* experiments (the doses are given frequently in the form of irradiation periods or in the form of units based arbitrarily on irradiation periods).

PROF. L. MOSZKOWICZ called attention to the experiment of R. Goldschmidt that was carried out parallel to Muller's researches. Goldschmidt reported that he succeeded by means of high temperatures in bringing about mutations in *Drosophila*. Likewise, Jollos states (*Naturwissenschaften*, Heft 8) that it is possible to produce a "directed mutation"; that is to say, a mutation process that progresses with respect to one particular character, if one exposes to high temperatures the impregnated ova for many successive generations. It would be interesting and important to know whether or not roentgen irradiations applied to several

generations have a similar effect, in which case possibly not such high doses would need to be applied as Muller employed. Defect mutations are, in Nature, often combined with progressive mutation of other characters.

PROF. G. HOLZKNECHT: Only as a listener—as a witness, I might say—I would like to defend the first speakers against Prof. Adler, and, at the same time, I wish to defend him also, by pointing out that his statement is doubtless due to the fact that he did not follow entirely the arguments of the speakers. He regards it as a contradiction that Dr. Borak, on the basis of the newer researches on hereditary transmission, states that the possibility of injury to human offspring by the irradiation of the gonads with roentgen rays is so slight that it need not be considered, and that Dr. Peller treats statistically the (slight) frequency of injuries to posterity. But I think he is mistaken. Dr. Peller, in a perfectly logical manner, took this stand: Assuming that the arguments of Borak are not true; assuming that—contrary to the results of researches—in the human race, in which experimental research is not possible, the conditions were as unfavorable as it is possible for them to be, namely, as unfavorable as in the *Drosophila* fly; assuming also in other respects the most unfavorable conditions, how great and how frequent, under these circumstances, would the injuries be, figured statistically? The result, it was found, is negligible—only one case of injury in several hundred years. There is no contradiction in this method of argumentation. It is a true scientific procedure to endeavor to clarify a question not only in one way but to consider that the truth is not attained until all erroneous paths have been studied exhaustively. This complete method of scientific study and research is unfortunately seldom carried out and is consequently somewhat unusual, and

that is evidently what confused Dr. Adler. The value of this complete method is, however, readily apparent. It is especially well adapted for the consideration of the dangers from irradiation, which the gynecologists allege are threatening (on the supposition that in questions pertaining to hereditary transmission all living beings are alike). Thus the groundlessness of the fears of the gynecologists was made evident and the harm resulting from this error was checked. Dr. Adler's further statements on damage to offspring, made in connection with hereditary injuries, will perhaps be discussed by another speaker.

DR. QUASTLER: The principle of radiobiology, that through irradiation no changes are brought about that cannot be produced by other causes, cannot be applied to the mutations. Serebrovsky and his co-workers found, during two years of experimentation, after roentgen irradiation, thirteen previously unknown mutations of a single gene (scute). It is questionable whether or not the mutations produced in *Drosophila* are comparable to those brought about therapeutically and in experiments on mammals. The employed doses of rays are absolutely incommensurable. (The Muller doses are multiples of the castration dose.) It may, for example, be possible that the mutation does not appear in mammals because the germinal cells, owing to greater sensitivity, perish long before the "mutation dose" is reached.

DR. HAUDEK, in a somewhat lengthy statement, pointed out the disadvantages for the patients that have arisen from the fact that, for some time, ovarian irradiations have been omitted to a great extent, and emphasized that the cases of irradiation in pregnancy on the supposition of the presence of a tumor belong in the realm of gynecologic and diagnostic errors.

CASE REPORTS

THE DEVELOPMENT OF MILIARY TUBERCULOSIS IN AN INFANT

By EDWARD C. VOGT, M.D.

From the Medical and Roentgenologic Departments
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BOSTON, MASS.

A female baby, 8 months of age, was admitted to the Infants' Hospital on January 16. Two weeks before entry she had developed a cough and running nose and seemed feverish, and these symptoms had persisted. The mother denied knowledge of any tuberculosis in the family or any contact. The child, bottle fed, had gained well and developed normally, except during a period when she was between three and six months of age, when she had had intermittent aural discharge.

On admission, moderate watery nasal discharge and a rather severe hacking cough

were noted. The patient's temperature was 100°. There were fine scattered râles over the mid and lower chest posteriorly on both sides and slight dullness at the left base. Physical examination was otherwise essentially negative. The liver and spleen were not palpable at this time. A film of the chest (Fig. 1) showed a moderate accentuation of the peribronchial markings medially and a narrow zone of hazy pulmonary infiltration at the left base. The tuberculin (1 to 1,000) and Wassermann tests were negative. The urine was normal.

During the first week in the hospital, the child's temperature varied between 98° and 100°, and her general condition had so much improved that she was thought to be about ready for discharge. However, on the tenth day (January 26) the temperature rose abruptly to 103°, although there was no

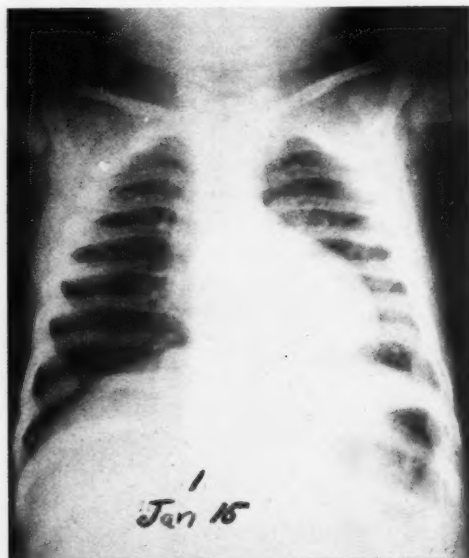


Fig. 1. Film taken on entry, showing a moderate amount of perihilar congestion and a zone of hazy infiltration at the left base. Probably an acute non-specific infection.

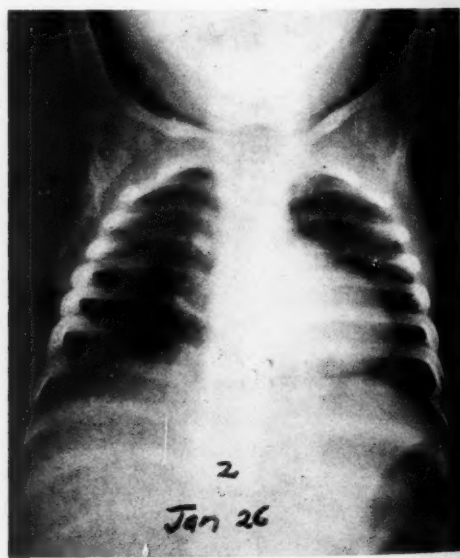


Fig. 2. Film taken ten days later. The lungs were clear. On this same day, the patient had an unexplained rise in temperature.

other perceptible change, another film of the chest (Fig. 2) showing the lung fields to be essentially clear.

On the fifteenth day (January 31), the child clinically seemed entirely well. A check-up chest film, however, showed a generalized, fine, flocculent infiltration throughout both lungs, suggestive of early miliary tuberculosis.

The tuberculin test was repeated and found to be positive.

The mother, who was again questioned, now told that an uncle, who had been living with the family, suddenly had become ill during the past week, dying in another hospital of pulmonary tuberculosis.

A week later (February 8) another film of the chest (Fig. 4) showed a generalized discrete miliary mottling of the lungs. The liver and spleen became palpable and numerous small tuberculides appeared over the back and thighs.

The baby continued happy and playful, held her weight, and her general condition remained remarkably good. She ran a persistent low-grade temperature, however, which ranged between 99° and 100° for the

following three weeks, but then very gradually stepped up to 102° .

By the eighth week she was becoming a bit fussy and losing a little weight.

On March 20th she suddenly developed signs of meningeal irritation. Lumbar puncture revealed definite changes in the cerebrospinal fluid (increased cells and globulin and a pellicle). Repeated examinations of the blood showed a slight leukocytosis increasing terminally, with a gradual rise in the monocyte and fall in the lymphocyte ratios. Modified monocytes were found by supravital staining.

The patient gradually passed into coma, and, with a preterminal temperature of 108° , died on March 27. This was ten weeks after entry and eight weeks after the first signs of tuberculosis were recognized.

Necropsy showed several caseous glands in the mediastinum and generalized miliary tuberculosis.

COMMENT

This case is presented because it illustrates quite graphically the development and

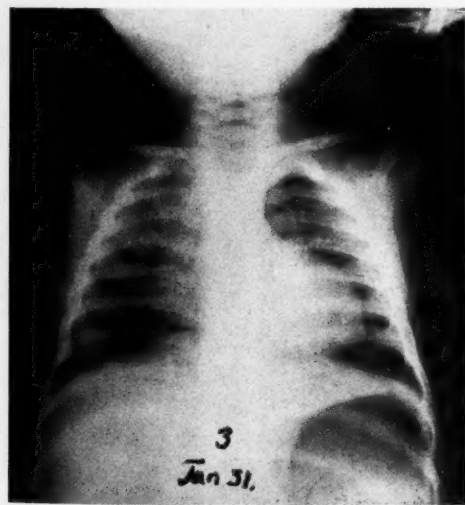


Fig. 3. First signs of miliary tuberculosis. There were no clinical signs at this time, except for a slight temperature.

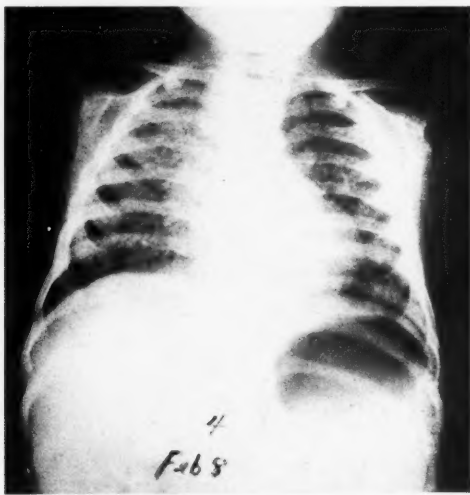


Fig. 4. Showing progressive fine mottling of generalized miliary tuberculosis.

subsequent course of miliary tuberculosis in an infant.

The patient entered the hospital with what was evidently an acute respiratory infection, which cleared up in about a week. However, on the tenth day, the temperature suddenly rose to 103° without any explanation being possible at the time.

Five days later, however, a roentgenogram of the chest showed a diffuse, fine, flocculent infiltration, this being the first evidence of the developing miliary tuberculosis.

The fact that the history and the tuberculin test, which were negative on entry, now both became positive is of interest, but of little significance otherwise, for the tuberculous infection certainly existed in the mediastinal lymph glands before the child's admission to the hospital. Subsequent films showed the progress of the tuberculous process in the lungs.

It seems not improbable that the bloodstream infection and generalized seeding took place on January 26, when the unexplained rise in the temperature occurred.

This case also demonstrates how good the clinical condition of a patient with miliary tuberculosis may continue until the vital intracranial structures become involved.

AN OPEN SAFETY PIN IN THE BRONCHUS: REMOVAL UNDER ROENTGENOSCOPIC GUIDANCE

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It is not uncommon to find open safety pins in the esophagus, but they are not often found in the tracheobronchial tree. In the case reported here the pin was in the bronchus.

A woman, thirty-five years of age, was examined on Feb. 23, 1921. For two years, she had had a paroxysmal cough which at first had not been associated with expectora-



Fig. 1. Open safety pin in left bronchus.

tion. A year after the onset of the cough, she had experienced vague distress in the left side of the thorax, that had been thought to be cardiac in origin. We were informed that roentgenoscopic examination of the thorax had disclosed what had appeared to be an open safety pin in the region of the left main bronchus, but since there was no history of the foreign body having been aspirated, and since the only respiratory symptom was a rather insignificant cough, it had been assumed that the pin was situated in the clothing. Soon afterward, however, the cough had become productive of small amounts of purulent expectoration. In May, 1930, the patient had become pregnant; there had been no complications until early in January, 1931, when pneumonia had developed and she had been very ill. The temperature each day had been 104° F.; the cough had become much worse, being accompanied by large amounts of malodorous purulent expectoration. A normal child had been delivered February 1. Soon

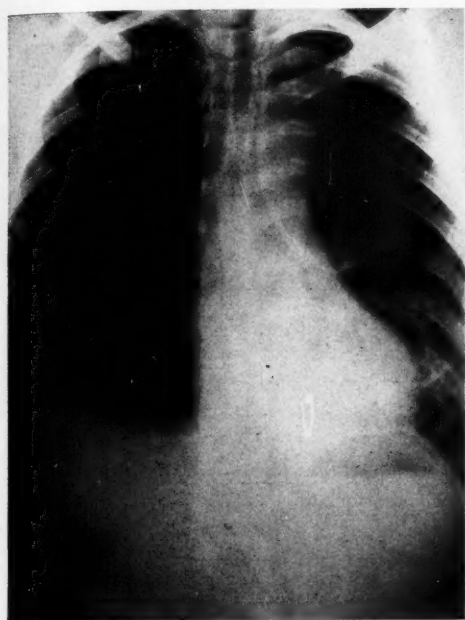


Fig. 2. Position of pin after first bronchoscopic examination.



Fig. 3. Safety pin in lower lobe of left lung. The pin has been rotated since the previous examination.

after this, roentgenographic examination of the thorax had revealed an open safety pin in the left main bronchus (Fig. 1) and the patient was referred to us for treatment.

February 25, bronchoscopic examination was made at the clinic under local anesthesia. The left main bronchus was found to be stenotic and filled with purulent secretion and a large amount of granulation tissue that bled freely with instrumentation. The foreign body was not seen, and it was assumed that it was buried in the granulation tissue. The stricture in the bronchus was dilated. Further roentgenoscopic studies revealed that the pin had dropped into the depths of the lower lobe of the left lung (Fig. 2).

A second bronchoscopic examination was made March 2, and, although the bronchi distal to the bronchial stricture were dilated, it was impossible to visualize the pin.

A third bronchoscopic examination was



Fig. 4. Safety pin after removal from bronchus.

made March 24 under roentgenoscopic guidance, and, although it was possible to grasp the point of the pin, it was impossible to

free it sufficiently to bring it up to the end of the bronchoscope. The keeper of the pin was grasped with forceps and the pin was rotated so that the point was directed laterally (Fig. 3). After considering the hazards of external operation for removal of the pin, it was finally decided that, by grasping the keeper and making direct traction, the point probably would not seriously injure the infected fibrotic pulmonary tissue.

June 12, a fourth bronchoscopic examination was made after intravenous injection of sodium ethyl (1-methylbutyl) barbiturate (nembutal). The anesthesia was satisfactory, and, under roentgenoscopic guidance, the keeper of the pin was grasped with forceps. When moderate traction was applied, the corroded pin broke at the spring and half of it was removed; the remainder was then easily withdrawn (Fig. 4). The patient was dismissed from observation June 15 in excellent condition.

OSTEITIS FIBROSA CYSTICA DUE TO HYPERPARATHYROIDISM

By ARTHUR R. BLOOM, M.D.,
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In recent years the rôle of the parathyroid gland in relation to certain diseases of the bones has assumed considerable proportions. This subject is of extreme importance to the roentgenologist because of the bony changes observed by the X-ray.

In 1904, Askanazy (1) first reported a case of generalized osteitis fibrosa, described by von Recklinghausen (2) in 1891, associated with a parathyroid tumor. In 1907, Erdheim (3) described three cases of osteomalacia in which there was hypertrophy or tumor formation of the parathyroids. This raised a question as to whether the hyperplastic condition of the parathyroid was primary and the skeletal changes secondary or

vice versa. Erdheim contended that the enlarged glands were a compensatory change due to the increased drain of calcium metabolism resulting from the bony condition. As late as 1926, Kerl (4) in describing a case of osteomalacia and osteoporosis, believed this possibility. However, most authorities are of the opinion that the enlarged parathyroid is the primary condition because usually one gland is adenomatous and because later work shows absolute cures in these cases when a parathyroidectomy has been performed.

In 1915, Schlagenhauser (5) suggested the possibility of removing the parathyroid gland but it was not until 1925 that the first parathyroidectomy was done for generalized osteitis fibrosa cystica by Mandl (6). The patient was cured of all symptoms.

The typical history of hyperparathyroidism is best described in the case reports of Snapper (7), Barr, Bulger, and Dixon (8), and others. The patient complains of severe pain over various parts of the body. There is a hypotonia of the skeletal muscles, pathologic fracture with delayed healing, high serum calcium, and cystic condition of the bones as shown by X-ray examination. There may be other calcium changes, such as urinary calculi, arteriosclerosis, etc.

Hubbard and Wentworth (9) described a case which they called metastatic calcification associated with chronic nephritis and hyperplasia of the parathyroids. There were numerous soft tumor masses over the body and aspiration of the fluid revealed 30 per cent calcium phosphate. There were beady nodules on the peripheral blood vessels and an excised piece showed that the media had been replaced by calcium. A range of from 11.9 mg. to 13.4 mg. showed in the serum calcium. Other blood studies were indicative of a high degree of nephritis. Autopsy revealed a severe interstitial nephritis with a right hydronephrosis. There were calcium deposits on the wall of the left auricle and of the various blood ves-

sels excepting those of the liver and spleen. There was an osteitis fibrosa of the skull, ribs, and vertebræ, and two large parathy-

Mrs. J. C. M., aged 30, a patient of the North End Clinic, was referred to me for X-ray examination. She stated that during



Fig. 1-A. Pelvis showing large cysts of left ilium and fracture and smaller cysts of right ilium. Fig. 1-B. Cyst of femur, with pathologic fracture.

roids showed hyperplasia, one being adenomatous.

Hunter, in the Goulstonian lectures given in 1930 (10), states that the term generalized osteitis fibrosa indicates a disease entity distinctly different from focal osteitis fibrosa. In the latter, there may be one or more focal lesions, the essential point being that outside of these areas the bony structure is normal. In the generalized disease, there is widespread pathologic resorption affecting all the bones. In addition there are multiple foci of osteitis fibrosa with or without benign giant-cell tumor and cyst. It is a disease which progresses with pain, fractures, and disabling deformities, being usually fatal.

Dr. Max Ballin, who has done considerable work on the subject of hyperparathyroidism, is of the opinion that some of the cases of focal osteitis fibrosa cystica are also the result of hyperparathyroidism. The following case shows this condition:

either 1917 or 1918 she fractured her leg near the hip. A cast was applied and she remained in bed eight weeks. She had no further trouble until about 1926, when she began to have pains in the left hip, following a myomectomy. At the onset of the pain, she was confined to bed for about two months. She then used crutches for two months and walked with a cane for two more months. The pain, which was dull, aching in character, and radiated down the leg, was aggravated by walking. Heat quieted the pain but never relieved it. It was practically continuous during the winter months, being worse at night and in the morning, but was very slight during the day. Upon sitting, she put more weight on the right side and she was able to climb stairs by placing her right foot first. On one occasion there was a swelling on the inner side of the leg. She used a cane irregularly. There was no temperature.

About two years before the X-ray exami-

nation, she developed a pain in the left elbow which was dull and aching in character, but did not radiate. It was aggravated by motion and became worse in the winter. She had no recollection of injuring the elbow. She had had measles, mumps, and whooping cough in childhood, and pneumonia in 1925. She had also had a myomectomy the same year. The family history was irrelevant.

Physical examination revealed a well-nourished and well-developed negress about 30 years of age who appeared subacutely ill. The eyes, ears, nose, and throat were normal. The reflexes were normal. The teeth had many crowns. The thyroid was slightly enlarged bilaterally.

The chest was equal on both sides. There were no breast tumors. There was normal tactile fremitus. There were no râles or adventitious sounds, and no areas of dullness.

The apex of the heart beat was palpable in the fifth interspace 8.5 cm. from the midsternal line. The left heart border was 9 cm., and the right border 2 cm., from the midsternal line. There were no murmurs or thrills. The pulse was slow and full. The blood pressure was 134/86.

On the abdomen, which was pendulous and tympanitic, there was a transverse incision 11 cm. above the pubis.

Special Examination.—There was limitation in flexion of the left leg and no crepitation over the old fracture. The callus could be palpated. The left leg was 1 cm. shorter than the right. There were no atrophy, edema, or varicosities, and no pain on motion. There was some tenderness over the left elbow externally, but no limitation in motion. The reflexes were very sluggish.

Jan. 1, 1931.—Blood count: Hemoglobin, 86 per cent. Red blood cells, 4,440,000. White blood cells, 9,850. Polymorphonuclears, 66 per cent. Lymphocytes, 34 per cent. Urine: negative on six occasions except for some pus cells. Calcium balance

studies showed less output than normal.

Jan. 9, 1931.—Blood serum calcium varied from 5 to 8.3 milligrams. Serum phosphate was 2.4 milligrams. Sugar 0.105 per cent. Non-protein nitrogen, 25 milligrams. Wassermann, negative. Basal metabolic rate, +1.

On Jan. 2, 1931, the electrocardiogram curve was essentially normal, while one taken on Feb. 6, 1931, showed slight myocardial damage.

X-ray Examination.—Films of the patient's dorsolumbar and sacral spine showed the bodies of the vertebrae to be normal in size, shape, number, and lime content. There were numerous large areas of decalcification of the entire left iliac bone and the acetabulum with cystic formation (Fig. 1). The left ilium was much smaller than the right. There was evidence of an old fracture running horizontally across the middle. The right ilium showed a similar, but a smaller, area of cystic formation, 6 cm. long. The cells were smaller. This area occupied the mesial inferior border near the sacral synchondrosis.

Film of the left femur showed large areas of cystic formation extending from the anatomical neck about 18 cm. down the shaft. The head was not involved. There was a horizontal fracture about 10 cm. below the trochanter with some reaction and spicules around it.

Films of the chest showed both apices to be clear. The costophrenic angles were clear. The domes of the diaphragm were smooth. There was some increase in peribronchial markings. The heart was within the range of normal as to size, shape, and position. The ribs were perfectly normal. There was no evidence of destruction. The skull was normal.

Anteroposterior views of the left elbow showed evidence of an evulsion fracture at the external condyle of the humerus. There was a spicula protruding from under it but

the rest of the long bones and the spine showed no changes.

X-ray Diagnosis:

1. Osteitis fibrosa cystica
2. Pathologic fracture of the femur
3. Pathologic fracture or collapse of the left iliac bone
4. Evulsion fracture of the external condyle of the left humerus
5. Probable hyperparathyroidism

Through the courtesy of Dr. Max Ballin, the patient was admitted to his service at Harper Hospital, where most of the above laboratory work was done. On Feb. 3, 1931, he performed the following operation.

Thyroparathyroidectomy.—Collar incision was made. The right lobe of the thyroid was first removed in the usual way by an extensive subtotal lobectomy. The gland bed was over-sutured by three interrupted catgut sutures and these were used for traction, turning the dissection bed of the thyroid inward. Through the areolar tissues exposed between the carotid on the outside and the trachea on the inside, a yellowish body, having the shape and size of a fairly large parathyroid, appeared. The bed was freed all around until the parathyroid branch artery at its communication with the inferior thyroid was exposed and was cut through and ligated.

The parathyroid body was dissected out and the patient phonated well throughout. (Dr. Morse pronounced the body a parathyroid.) The same procedure was followed on the left side with the same findings and, in addition to the same type of parathyroid body, a third one was found buried in the thyroid structure itself.

Microscopic Examination (Dr. Plinn Morse).—The thyroid was adenomatous with excessive lymphoid infiltration. One of the parathyroid bodies was normal in appearance except for marked lymphoid reaction in the surrounding fat tissue reminiscent of thymus. The other parathyroid body showed a moderate hypertrophy of

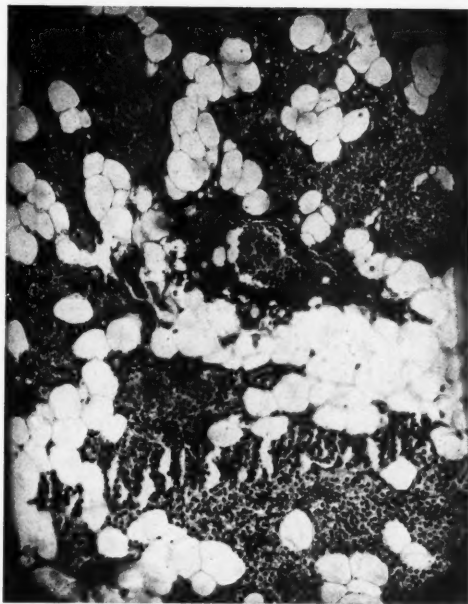


Fig. 2. Photomicrograph of parathyroid, showing adenomatous area in center.

adenomatous type (Fig. 2). A third parathyroid body presented numerous small hemorrhages, probably a rupture of the capillaries during the operative procedure.

Post-operative Treatment.—Parathormone units, 20 daily. Lugol's solution, 5 minims three times daily. Viosterol, 10 minims three times daily. Blood calcium 8.1 milligrams.

The patient was discharged from the hospital on March 5, 1931, having been given a sacro-iliac support with hip attachment. There was about one-half inch elevation of the left foot. The patient had no pain.

May 5, 1931.—The patient returned to the office of Dr. Ballin for examination. She walked well without the use of either cane or crutches, and was free from pain. She stated that she felt better than she had for seven years.

X-ray Examination (Dr. Ballin's office).—Stereoscopic plates were made of the left

hip and femur and the left half of the pelvis. There was evidence of extensive cystic formation in the upper end of the femur. This extended from the junction of the upper and middle third of the shaft of the bone upward and involved both the lesser and greater trochanter. This fracture was in good position and had a good bony union. The left ilium showed a marked deformity, evidently due to an old fracture across its body, which showed good healing. There was also multiple cystic formation in the upper portion of the ilium. The findings were those of osteitis fibrosa cystica. When compared with the previous examination, the lime content seemed to be slightly greater.

COMMENT

Here is a case in which many of the so-called essential factors of hyperparathyroidism were lacking, yet microscopic examination showed an adenoma of the parathyroid and the patient is clinically improved after the operation.

The question of calcium content in these cases is not completely settled. Dr. Ballin has shown in a number of instances that it is variable. He has had numerous cases in which there were many normal readings, yet at one time or another a high reading was present and the operation resulted in cure. Other cases have never had a serum calcium reading of over eight.

A recent article on this subject by Barr and Bulger (11) states: "It is possible that hyperparathyroidism may exist in the absence of hypercalcemia. The parathyroids are not only one factor in the maintenance of the serum calcium level. The absence of Vitamin D or of sunlight may be mentioned as causative in the lower calcium value found in rickets. The recent work of Nitschke indicates that the thymus and lymph nodes may be effective in lower serum calcium. In nephritis the retention of

phosphorus is accompanied by hypocalcemia. In rickets both of animals and children, and in some cases of nephritis, hyperplasia of the parathyroid has been demonstrated. This may represent a need for increased parathyroid function and may be secondary to factors having a tendency to reduce the level of serum calcium. Thus one could consider the serum calcium value in a case of rickets a resultant of two opposing factors, the absence of Vitamin D tending to lower it while the enlarged parathyroid tends to raise it. Hyperparathyroidism in the sense of increased functional activity might exist without hypercalcemia as indeed it does in the presence of low values of serum calcium."

Although there was a normal serum calcium reading in this case, there was some change in this patient's calcium metabolism. This case shows that the whole situation of hyperparathyroidism and osteitis fibrosa is far from settled.

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EDITORIAL

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BUNDY ALLEN, M.D. . . . Associate Editor

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THE STIMULATIVE EFFECT OF ROENTGEN RAYS ON THE GLANDS OF INTERNAL SECRETION

A biologic basis for the stimulative action of roentgen rays is found in the Arndt-Schultz law which states that weak stimuli accelerate vital processes, moderate promote them, strong inhibit them, and strongest destroy them. The increased functional activity noted after radiation is interpreted according to two viewpoints: Fraenkel believes that there is a direct stimulative effect on the cells in accordance with the Arndt-Schultz law, while Holzknecht and his school deny any stimulative action, claiming that X-rays always destroy no matter in what dosage. They contend that the increased cellular activity is due to the freeing of a restraining influence of a depressing factor.

Thousands of experiments have been performed on seeds, vegetation, plants, and micro-organisms demonstrating that this law is valid and is applicable to the action of X-rays. This law is denied by others who, in addition, feel that the entire concept of growth promotion in plants and in unicellular organisms is not equivalent to that of the complex mechanism obtaining in the human body.

To evaluate or compare results in the reported cases is difficult because of lack of uniformity in expression of dosage and in standardization of strength. The small dose of one author is a moderate strength dose of another.

The widest application of small dosage radiation has been in the field of gynecology. There is enough clinical evidence showing favorable results from weak irradiation of the ovary to justify use of the X-ray in carefully selected cases. Successful outcome has been reported by many authors in more than 50 per cent of their cases of amenorrhea, evidenced by the return of a normal, regular, menstrual cycle and in the occurrence of more than 200 instances of a subsequent pregnancy with the delivery of a normal infant in all but 2 per cent of the cases. While some minimize the dangers, the possibility of germinal injury must be thought of in the ovarian radiation of any woman during the reproductive period. The results in the treatment of dysmenorrhea and oligomenorrhea have been fair. Some authors claim that, in gynecologic conditions, the ultimate outcome of radiation therapy depends upon the age of the patient, the duration of the disorder, and the thickness of the abdominal walls.

Untoward symptoms of both physiologic and artificial climacteric periods have been treated by irradiation of the pituitary, thyroid, and ovaries with amelioration in most instances. Some administered large or middle-sized doses to the pituitary or thyroid, others utilized small radiation of these glands, while still others used so-called small doses on all three glands. If the symptom-complex is due to hyperactivity of the thyroid and pituitary glands with a hypoactiv-

ity of the ovary, then it is difficult to consider improvement from the viewpoint of stimulation of all the glands involved. It is fallacious to conceive of stimulation in all three glands by small dose radiation. If simultaneous or individual treatment of hypophysis or thyroid in weak intensities brings about an improvement in this supposedly hyperactive syndrome, then small doses in this instance are not stimulative.

Pituitary therapy in impaired hearing, as advocated by Stokes, has no scientific basis and the results are not considered as being due to stimulation of this gland even by the majority of those who have obtained good results following use of irradiation.

Treatment of Frölich syndrome has not been uniformly successful with weak irradiation, especially when accompanied by amenorrhea.

The radiosensitivity of the adrenals is so marked that it is difficult to state in advance what the result will be with any given dose. For this reason the effects of weak irradiation of this gland have not been uniform, some of them having been increased in blood pressure and in the blood sugar level. A few instances of improvement in Addison's disease have been reported.

In spite of the fairly frequent occurrence of the condition, there is a paucity of information on the utilization of weak radiation of the thyroid in hypothyroid states. Increased functional activity, as evidenced by an increase in basal metabolism and sugar metabolism, has been noted in the laboratory. Improvement in eczema and scleroderma and in ovarian dysfunction due to hypothyroidism has been reported, but, in the latter condition, benefits are noted only during the time of simultaneous oral administration of thyroid extract.

Startling results are reported by Wieser, of Vienna, in the treatment of childhood endocrinopathies and related conditions, including Mongolian idiocy, by irradiation of

the pituitary, thyroid, and gonads. Where the diagnosis cannot be made upon the history and clinical picture, the Abderhalden test and gas exchange are utilized.

There are no available reports on the effect of radiation of the parathyroid. It would be difficult to radiate this gland without at the same time striking the thyroid.

Exacting experiments by Lenz force him to the conclusion that there is no evidence of any stimulative effect on the thymus as the result of weak irradiation. M. Fraenkel has recently advanced the opinion that certain endocrine glands possess an anticancer influence and, upon this basis, he advises weak stimulative irradiation of the thymus and thyroid. This concept is of too recent date to be discussed here. Improvement has been noted by several in the irradiation of the thymus in certain skin conditions.

In the literature there are a number of case reports on the beneficial effect of small dose radiation in diabetes mellitus; on analyzing the original papers, however, it is found that either the exact doses are not mentioned or else a strength above 25 per cent Holzknecht erythema dose was used—surely not an example of a small dose. The results obtained by small dosage radiation of the pancreas are not sufficiently definite to warrant the expression of any opinion at the present time. Increased carbohydrate tolerance has been reported after weak irradiation, but it is felt that the clinical application of this method of treatment be not considered in the management of diabetes mellitus until there is further light on this subject.

There is very little available literature on the testes or pineal gland.

The question at issue is not the presence of an increase in body weight, activity and functional capacity following irradiation in small doses of X-rays, but the determination as to the fundamental underlying cause of this reaction—is it a direct stimulative effect

or is it the result of complicated processes not stimulative in nature?

From a clinical viewpoint, weak irradiation does increase functional activity as especially illustrated in the treatment of gynecologic disorders by irradiation of the ovaries. The clinical application of pituitary radiation, while beneficial, does not imply always a stimulating action; some of the results are probably due to destructive effects. The results noted in the treatment of childhood endocrinopathies by irradiation of the thyroid, pituitary, and gonads are startling, at the hands of one particular investigator, but they should be confirmed by others before they can be accepted. Radiation of the adrenals, pancreas, testes, and parathyroid has not given us any definite information as yet in the treatment of dysfunction of these glands.

Stimulation by means of roentgen rays may in time be one of the methods of procedure in the treatment of endocrinopathies, but, before this is possible, it must be placed upon a scientific, accurate, and rational basis. A proper knowledge of the underlying endocrine factors in the causation of the disease and a standardized method of radiation, with a standardized table of dosage, are requisites before any hope can be entertained for success in stimulative radiation.

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Brooklyn, N. Y.

RADIOLOGIC PATHOLOGY

A study of the medical literature from its very beginning reveals the fact that the progressive development of medicine has been made possible largely by a proper appreciation of the value of pathology. Scientific investigations and experiments conducted by pathologists throughout the world have furnished to the medical profession basic information concerning certain diseases which could not have been obtained in any

other manner. The radiological profession has a very high regard for this branch of medicine, and its value is demonstrated every day by the magnificent results obtained in the radiological diagnosis and treatment of disease.

Surgical pathology occupies an important position in the practice of surgery, and its value has been realized by the surgeon for many years; without this knowledge, a surgeon is often considered simply an operator. Radiological pathology is of the same value to radiologists as surgical pathology is to the surgeons.

It is not our desire to enter into a lengthy dissertation on the various pathologic entities which are susceptible to radiologic diagnosis and also pathologic lesions which are radiosensitive and respond to radiation therapy, but we wish to impress our readers with the importance of the application of histopathology, and pathology as an invaluable aid in the diagnosis and treatment of disease.

Every radiologist should acquire some understanding of the histogenesis, physiology, and pathology of the various lesions which respond to radiation therapy. The application of such knowledge is by no means restricted to radiation therapy: it has become of great importance in radiologic diagnosis. For instance, the roentgenological diagnosis of certain osteogenic bone sarcomas is made possible by an understanding of their histogenetic differences. This is very important, as some of these tumors are radiosensitive and others radioresistant, and in order that radiation therapy may be used effectively, a correct diagnosis is absolutely essential. Then again, in the instance of Ewing's bone sarcoma, its histogenesis is valuable in interpreting the X-ray film. According to Geschickter, this tumor arises in all probability about the lymphatics of bone in the subperiosteal regions and in the Haversian canals. This mode of origin accounts for both the

manner in which the tumor spreads and the early stimulation of reactive new bone. The growth extends beneath the periosteum, giving an elliptical area of involvement, and permeates the Haversian spaces, simulating the widening of the shaft so characteristic in the X-ray film.

The knowledge of radiologic pathology is the means by which a distinction can be made among radiologists, physicians, and non-medical men who employ radiant energy in the practice of medicine. In the instance of the radiologists, a diagnosis is made by interpreting certain definite pathologic manifestations observed in the fluoroscopic and skiagraphic examination of a patient. His cognition of radiologic pathology has taught him that certain abnormal changes in the body structures will cast different shadows than normal surrounding tissues, due to the difference in their absorability rate, and in this manner the pathologic areas involved are easily detected. A comparative study of the abnormal shadows obtained in radiological examinations with the actual pathologic lesions found by the pathologist through postmortem examinations, by biopsies, or by the examination of exudative materials, forms the essential or absolute foundation of radiologic science. It is almost entirely through this means that accurate radiologic information has been made possible, since the pathologic lesion is the cause of abnormal radiologic findings.

Our successes and failures will depend largely upon our appreciation of this very important branch of medicine. The empirical treatment of tumors and lesions of the human body by means of radiation therapy, without making an effort to ascertain their pathology, which often determines their radiosensitivity, is a practice to be severely censured.

In order that radiologists might better understand microscopic pathology, RADIOLOGY has already requested the co-operation of authors presenting photomicrographs with

their articles for publication, to point out by markers the normal and pathologic cells and structures under consideration. In this manner we hope that our readers will become more interested in this form of pathologic examination. While it is not expected of a radiologist that he become a pathologist, it is expected that his knowledge of pathology should be sufficiently broad to permit him to understand intelligently the many pathologic conditions which he is called upon to diagnose and treat.

At a recent meeting of one of our large national surgical societies, a very interesting discussion was held by some of the members present. It was suggested that some effort be made to weed out the incompetent surgeons by a system of grading, and one of America's well known surgeons is said to have stated: "A mechanic must serve an apprenticeship before he is permitted to take an automobile apart; why should not a young surgeon be trained under a responsible man before he is permitted to carve up a human body?" Such constructive ideas are perhaps timely, as no doubt many physicians consider themselves surgeons because their license to practise medicine does not restrict them from wielding a surgeon's knife. The radiological profession has practically the same condition to contend with. Many physicians and surgeons who are not radiologists use certain radiologic equipment in their practice, making erroneous diagnoses because they lack radiologic-pathologic knowledge, and, for the same reason, become a factor of danger when treating patients with such a potentially dangerous agency as the X-rays.

Radiologic pathology is the foundation stone upon which must rest the future progress of radiology. It is the indispensable foundation for successful radiologic work. If it is applied with intelligence in the diagnosis and treatment of disease, it will be the means whereby radiology will be able to resist every attack made against it.

COMMUNICATIONS

THIRD INTERNATIONAL CONFERENCE OF THE AMERICAN COLLEGE OF RADIOLOGY

In keeping with the established custom, the Executive Secretary of the College arranged for its regular International Conference to be held at the time of the International Congress of Radiology, in this instance in Paris, France, on July 29, 1931, at Cercle Interallies (The Interallies Club of Paris).

Inasmuch as the President of the Third International Congress, Dr. Antoine Bécère, had been advanced to Honorary Fellowship in the College during its conference at Stockholm, Sweden, in 1928, and also as the Secretary-General of the Congress, Dr. Ledoux-Lebard, would be honored with the same degree during this Conference in Paris, our Executive Secretary was able to enlist their very kind co-operation in selecting a time when no conflict would occur with other proceedings in the great program of the Congress, as well as in choosing the place where facilities were unsurpassable and the general environment ideal.

The Fellows were met as they appeared at the Club by a management showing every possible manifestation of hospitality and were directed to an assembly room where the decorations and the conveniences were most appropriate. Here the Fellows met one another and at close range interchanged opinions, thereby binding still more firmly the bonds of friendship and fellowship amongst the leading figures in the Science of Radiology to-day.

At no time does the first object of the College's constitution seem to be more truly achieved than during these international conferences.

After the Fellows were all assembled, they were called to order by President-elect Soiland, who announced that the College

would now confer the Honorary Degree upon Dr. René Ledoux-Lebard, of Paris, France, and upon Dr. Hans R. Schinz, of Zurich, Switzerland.

In the absence of Fellow A. C. Christie, the President of the College, the Convocation was conducted by Fellow George E. Pfahler, who served as the first Presiding Officer of the College.

Following the Convocation, a few appropriate remarks of appreciation were made by Fellow Ledoux-Lebard, and Fellow Schinz also responded with a brief and appropriate statement, delivered in German and translated into English by Fellow Ledoux-Lebard.

At this point Fellow Bundy Allen appealed to the Chair for the privilege of the floor, which was granted. He addressed Fellow Bécère as President of the Third International Congress, complimenting him, his personal staff, and associates, for the wonderful program and the efficient and satisfactory manner in which it had been executed. Fellow Allen also stated that as the President of the Radiological Society of North America, he wished to convey the approbation and good wishes of that organization and, further, that he wanted to take this opportunity to present to Fellow Bécère a personal gift, which he had ordered made for this special occasion. With a few very fitting remarks Fellow Allen presented the gift, which consisted of a special hand-made humidior, mounted with a suitably engraved silver plate and filled with a very fine grade of cigars, wrapped and labeled for Fellow Bécère.

President-elect Soiland then extended a hearty welcome to the Honorary Fellows, as guests of the College, at luncheon, and requested the Fellows to repair to the Roof Garden following the luncheon, where coffee would be served and business of the Conference would be conducted.

Thirty-one Fellows of the College, rep-

resenting ten of the principal countries of the world, were assembled on the Roof Garden of the Club for coffee. At this point Madame Marie Curie was received by the officers of the College, and its Gold Medal was presented to her by President-elect Soiland. The Honorary Degree was conferred by Past-president Pfahler. The rare privilege of meeting this most modest and honored of all living scientists in the realm of radiology was an occasion that will never be erased from the memories of the Fellows who were fortunate enough to be present.

Handshaking and bidding adieu was the final order of the conference, and with each clasp went the hope that we should all live to enjoy the next conference in 1934 at Zurich, Switzerland.

B. H. ORNDOFF, M.D.
Executive Secretary.

ROLL CALL

Bundy Allen, M.D.
*A. E. Barclay, M.D.
*Antoine B  cl  re, M.D.
*Elis G. E. Berven, M.D.
Patrick F. Butler, M.D.
W. E. Chamberlain, M.D.
*Mme. Marie Curie
*Lars Edling, M.D.
Edwin C. Ernst, M.D.
*Jacques Forestier, M.D.
Clyde K. Hasley, M.D.
*Fedor Haenisch, M.D.
*Severin A. Heyerdahl, M.D.
*C. Thurstan Holland, M.D.
*Hermann Holthusen, M.D.
W. A. LaField, M.D.
*Ren   Ledoux-Lebard, M.D.
Leon T. LeWald, M.D.
Robert J. May, M.D.
Frederick W. O'Brien, M.D.
Benjamin H. Orndoff, M.D.
Eugene P. Pendergrass, M.D.
George E. Pfahler, M.D.
Ernst A. Pohle, M.D., Ph.D.

*Honorary Fellow.

Charles W. Prowd, M.D.
*J. A. Saralegui, M.D.
*Hans Schinz, M.D.
Albert Soiland, M.D.
Pasquale Tandoja, M.D.
Charles A. Waters, M.D.
William C. Wescott, M.D.

MINNESOTA RADIOLOGICAL SOCIETY

A combined meeting of the Minnesota Radiological Society, the Iowa X-ray Club, and the Radiological Section of the Wisconsin State Medical Society was held at the Mayo Clinic, Rochester, Minnesota, October 17, 1931. The Societies were honored by the presence of Charles H. Mayo, M.D., who delivered an address of welcome, and Lewis Gregory Cole, M.D., of New York, who was the guest speaker. The following program was presented:

1. Roundtable discussion of Gastro-intestinal Diseases.
Conducted by LEWIS GREGORY COLE, M.D., New York.
2. Benign Tumors of the Stomach.
LEO G. RIGLER, M.D., Minneapolis.
Discussed by L. G. COLE, M.D., J. D. CAMP, M.D., C. G. SUTHERLAND, M.B. (Tor.).
3. Fractures about the Ankle Joint.
M. S. HENDERSON, M.D., Rochester, Minnesota.
Discussed by W. H. UDE, M.D., and G. T. NORDIN, M.D.
4. Results of Radiation Therapy in Carcinoma of the Skin.
L. G. ERICKSEN, M.D., and K. W. STENSTROM, Ph.D., Minneapolis.
Discussed by GAGE CLEMENT, M.D., HAMILTON MONTGOMERY, M.D., and S. W. HARRINGTON, M.D.
5. Intrathoracic Tumors.
S. W. HARRINGTON, M.D., Rochester.
Discussed by C. H. MAYO, M.D., and L. G. RIGLER, M.D.

6. Tuberculosis in Children.

T. A. BURCHAM, M.D., Des Moines.

Discussed by E. S. HEWITT, M.D.,
ARNOLD ANDERSON, M.D., L. G.
RIGLER, M.D.

7. Bone Changes in Hyperparathyroidism.

JOHN D. CAMP, M.D., Rochester.

Discussed by J. DE J. PEMBERTON,
M.D., and R. M. WILDER, M.D.

Following the banquet the principal address of the meeting was delivered: Correlation of the Roentgenologic Appearance with the Pathologic Changes of Gastric Ulcer. Lewis Gregory Cole, M.D., New York.

LEO G. RIGLER, M.D., *Secretary,*
Minnesota Radiological Society.

THE AMERICAN COLLEGE OF PHYSICIANS

The Sixteenth Annual Clinical Session of the American College of Physicians will be held in San Francisco, California, April 4-8, 1932. The headquarters in San Francisco will be the Palace Hotel, where the general scientific sessions, registration, and exhibits will be held. Clinics will be conducted in various hospitals and institutions in San Francisco and nearby communities.

S. Marx White, M.D., Minneapolis, President of the College, has in charge the selection of speakers and subjects on the general program, while William J. Kerr, M.D., San Francisco, Professor of Medicine at the University of California Medical School, is the General Chairman of the Session, and is responsible for all local arrangements, in addition to the arrangement of programs and demonstrations. Following the San Francisco Session a post-convention tour will be conducted through Yosemite Valley, Southern California (with two days in Los Angeles), and the Grand Canyon of Arizona.

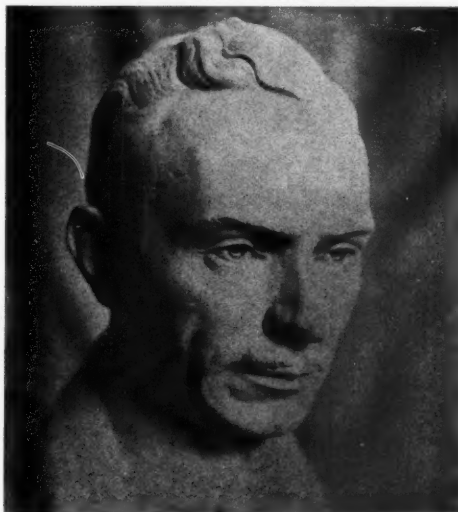
The attention of the secretaries of vari-

ous societies is called to the above dates, in the hope that their societies will select non-conflicting dates for their 1932 meetings.

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

The eighty-ninth meeting of the American Association for the Advancement of Science at which 26 associated scientific societies will have programs, will be held in New Orleans from December 28, 1931, to January 2, 1932, under the Presidency of Dr. Franz Boaz, of Columbia University, with Tulane University as the host institution and Prof. D. S. Elliott as chairman of the local committee. Numerous scientific papers in the section of physics (American Physical Society) and others will be of interest to members of the Radiological Society. It will be remembered that among others the epochal papers by Prof. H. J. Müller, of the University of Texas, on the effect of X-rays on *Drosophila*, and by Tuve and associates, of the Carnegie Institute, on a million-volt X-ray tube, won the annual prize offered by the Association for the outstanding contribution. Visitors are welcome at the Association meetings.

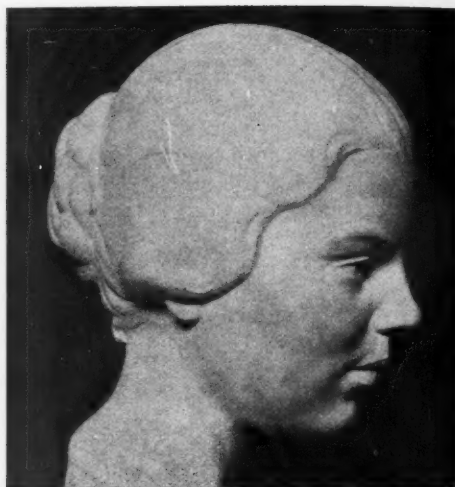
IN MEMORIAM



PROF. DR. GUIDO HOLZKNECHT



FRAU HOLZKNECHT

FRÄULEIN ELISABETH MARGARETHE, adopted daughter
of Prof. Holz knecht

PROFESSOR DOCTOR GUIDO L. ED. HOLZKNECHT

The late Professor Holz knecht was born in Vienna, Austria, on Dec. 3, 1872. His parents came from that old Viennese bourgeoisie which constitutes the pride of the Vienna *Gemütlichkeit* (easy going ways) up to our own days. His father, Guido, was a manufacturer and always well to do, but he died soon after his son finished his medical studies, leaving his mother, Ludovica Siebert, in his charge and in that of another son, Othmar Holz knecht. His brother, however, soon emigrated to the United States and lives in Chicago. His paternal grandfather was an apothecary, while his maternal grandfather conducted a turning shop of that fine art furniture which you may still see in the houses of Vienna's better class.

He married Carola Dittmar and adopted Elisabeth Margarethe, her daughter by a previous marriage. He devoted all his energy to his work, often spending eighteen or more hours a day in his office, sometimes subsisting on a pair of wieners and a slice of whole wheat bread between his noon meal and midnight.

After finishing his Gymnasium in 1891 he enrolled as a medical student at the University of Vienna, where he was graduated in 1897. Already, during his pre-graduating years, he visited the faculties of Strassburg, where he was one of the ardent students under Gustave Albert Schwalbe, whose very close friend he later became. In those days he hoped to devote himself either to pathology or surgery, and, likewise in Strassburg, took active part in the researches of F. L. Goltz, the physiologist, upon whose experiments he tried to improve. By Ludwig Lichtheim, of Königsberg, he was introduced into the relations between nervous and mental disorders and on his return to Vienna he completed his knowledge of brain pathology under Hermann Nothnagel.

The then new science of roentgenology had already attracted him before his graduation and he used to say that were he not endowed with an iron determination he would have failed in his examinations for the doctorate because he devoted too much time to the science of physics, particularly in its relation with cathode rays and the chemistry of luminous bodies. And while studying under Schwalbe and Goltz he was a frequent

visitor at the laboratory of Professor Roentgen, and when, three years later, the latter received a professorship in Giessen, Holz-knecht returned to Vienna and established himself as a specialist in medical roentgenology, the first to do that in the German-speaking countries. He was soon followed by Kienböck, in Vienna, and Groedel, in Hamburg.

In 1904 he was the first to publish a method for the measurement of X-rays and although he later accepted the Sabouraud-et-Noiré radiometer as a (second) basis for his modified and improved standard of measurements, it has been proven beyond a doubt that he was the originator of the radiometer. Some French radiologists and many German have not departed from its use even in our own days. The entire composition of his reagent bodies has not yet been disclosed; besides potassium sulphate and sodium carbonate we know nothing of the other ingredients. The so-called Holz-knecht Unit ("H") was arbitrarily accepted by him and it was later established that three to four "H" were equal to one erythema dose. This chromoradiometer was soon accepted in all X-ray laboratories and, later on, not only the surface dose was measured with it but also the dose administered in the depth. Later modifications by Grashey, particularly in connection with filtering, distance, and multiple fields, were initiated under Holz-knecht's guidance.

Hemmeter mentions that he was the first to visualize the abdominal intestines under the fluoroscope. Having no reason to disavow his statement, I must, however, emphasize the fact that as early as 1897 Holz-knecht practised the visualization of the stomach by means of air or various other contrasting administrations and in one of his earliest recipes we find the following: "Bismuti carbonici 3'0; Da in capsulis gelatinosis, ut compleantur." This was written in 1898 soon after Rumpel's discovery. Peristalsis was studied by him rather exten-

sively and although not all of his discoveries have retained their validity with us to-day we must acknowledge his pioneer mind in the entire field of intestinal disorders. Phrases like "constriction ring," "habitus enteroptoticus"—later modified by Stiller—"haustrations," "steer-horn-stomach," "pylorospasmus" and many other new coinings all go back to the initiative of Holz-knecht. The controversy as to whether or not the pylorus is the lowest point in the stomach and whether or not this position constitutes "the optimum for its function," as maintained by Holz-knecht and contradicted by Rieder and Rosenthal, is still vivid in the mind of the writer, although it has lost its entire significance. Even Kaufmann had joined Holz-knecht in the assumption that the peristaltic furrows become deeper toward the pylorus, along with the progress of the boli. Discarded also is his idea of a concentrated antral contraction and the so-called "gastric cycle." But he has given food for thought to all those who worked with and under him, a true scientist and a daring pioneer in a field that was still untrodden and obscure. His pupils like Haudek, G. Schwarz, Lenk, Porges, G. Singer, and many others have acquired great names under him.

In 1906 he was the first to diagnose cancer of the stomach, differentiating it from ulcer. At the same time he conducted his researches into the picture of syphilitic osteochondrosis. These and many other successful investigations have drawn the attention of the scientific world to him and in 1908 he was appointed director of the roentgen laboratories of the Allgemeines Krankenhaus (the University and General Hospital), of Vienna, with the title, a year later, of Dozent (assistant professor) for medical roentgenology of the University. This was the first appointment of its kind in Europe, all the other titles having been received in established branches of medicine. During the War he received the professorship ex-

traordinary and at the same time his nomination of Oberstabsarzt (lieutenant colonel) and inspector-general of all X-ray stations. It was at this period that his ideas of the "Symptom Complex" and the "Sign Complex" took root. Roentgenologists in those days took too much stock in their own findings, forgetting, as he used to say, that they are primarily physicians. For this reason he was a strong advocate of combining the signs and data of the roentgenogram with the symptoms and findings of the other examinations. At this period he was also one of the very few to observe the peristalsis of the duodenum and the "slow" peristaltic waves in the larger intestines, maintaining for the first time that haustrations have nothing to do with peristalsis. If I am not mistaken, the word "Skybalon" was then used by him for the first time.

Before concluding I must admit that I have omitted much of Holzkecht's life and work. I have not had enough time to prepare myself and it is very likely that I have made many a mistake. But his death came so suddenly and so unexpectedly—he was only 59 years old. I have known him intimately and I have had frequent occasion to observe how unstintingly he gave of his health and energy for the advancement of his science. The terrible dermatitis which developed on both his hands and caused him to lose one phalanx after the other and finally an entire arm caused untold suffering and misery to this high-minded man. He used to irradiate his hands in order, as he said, to palliate his sufferings. But all that did not keep him from writing with what was left of his right hand.

Of his works may be mentioned "Röntgenologische Diagnostik der Erkrankungen der Brusteingeweide" (X-ray Diagnosis of the Diseases of the Thoracic Intestines) (1901); "Röntgenologische Diagnostik der Intra- und Extra-ventriculären Tumoren" (X-ray Diagnosis of Tumors Growing in or

outside the Stomach) (1908); "Röntgenologie," completed in two volumes in 1921. The new edition of the second volume was later adapted by I. Seth Hirsch, M.D., in his "X-Ray Therapy."

I must correct the mention in the International Encyclopedia that Professor Holzkecht was the indirect cause of Gertrude Atherton's novel "Black Oxen," issued in 1923. In this novel the Countess Josef Batiany, née Mary Ogden, becomes rejuvenated through the application of "certain" rays. In his collaboration with Dr. Steinach, Professor Holzkecht had merely the pathologic and physiologic view in mind. With the knowledge he had of the devastating influence of the X-rays upon potency, I know that he gave up these fruitless experiments long before the War, and it is entirely unnecessary to drag his name into the making of a novel that, aside from its excellent literary value, aimed to be sensational long after everyone had stopped believing in such "rejuvenating" rays.

Professor Holzkecht was President of the International Society of University Professors of Medical Radiology, which he had created. He also was honorary member of the American Roentgen Society; of the Radiological Society of North America; of the Roentgen Societies of London, Italy, and Russia; of the Society of German Radiologists of Czechoslovakia, of the Mexican Roentgen Society, among others.

In conclusion, I would add that Dr. Holzkecht was the first to introduce the surgical removal of foreign bodies under the fluoroscope, during the Spanish-American War, when he stood in direct correspondence with some of his friends who took part and to whom he submitted his idea. During the World War the procedure was considerably facilitated through the use of the vacuum tube.

ICIO JOSEPHS, M.D.

BOOK REVIEWS

ROENTGENCINEMATOGRAPHY AND ITS APPLICATIONS: PLANE KYMOGRAPHY AND KYMOSCOPY (Das Röntgenographische Bewegungsbild und seine Anwendung). By PLEIKART STUMPF. With an introduction by Dr. GOTTFRIED BOEHM. With 117 figures; 78 pages. Supplementary volume XLI of Archiv und Atlas der normalen und pathologischen Anatomie in typischen Röntgenbildern. Published by Georg Thieme, Leipzig, 1931. Price, 15 marks; bound, 17 marks.

In the present work, the author has collected into one monograph the many publications he has brought out over a period of years on plane kymography, and he has enlarged and developed the subject in a very practical way. The methods of registering movements of deep-lying organs of the body in a scientific, exact, reproducible way are still decidedly confusing and need further clinical diagnostic development. Even though the technic, aside from the special apparatus, seems simple, it may, nevertheless, furnish much information and instruction to one who makes a study of the pictures produced by it. Stumpf has, therefore, placed great importance on the presentation of the normal and its relationships. After a discussion of the physiologic changes in the motion of the heart induced by breathing, exercise, etc., the author presents pictures of the movements found in pathologic changes in the heart and great vessels. Later, pictures of the movements of the diaphragm, the act of swallowing, the esophagus and the stomach are shown. Apparatus and technic are shown very clearly. Numerous illustrations facilitate the introduction to this subject of those who are not familiar with the author's earlier publications.

F. HAENISCH, M.D.

Translation by E. T. LEDDY, M.D., Mayo Clinic.

TEXT-BOOK OF ROENTGENSTEREOSCOPY (Lehrbuch der Röntgenstereoskopie). By MAX COHN and W. BARTH. With 193 figures in the text and two tables with movable stereographs; 323 pages. Published by Georg Thieme, Leipzig, 1931. Price, 30 marks; bound, 33 marks.

Cohn, a radiologist, and Barth, a physicist, have collaborated in writing a text on stereoscopy from a clinical and technical point of view. In his introductory remarks, Cohn points out the value of stereoscopy for instruction, research, and diagnosis. The considerations of methods, their principle and technic, on subjective stereoscopy and on roentgen-stereometry, including stereoscopic measuring apparatus, were written by Barth, while Cohn in a general and a special section discusses the applications of this procedure, together with its indications, to the examination of the various regions of the body, all being illustrated by typical examples. This book presents a comprehensive exposition of the subject on which there is no comparable work.

F. HAENISCH, M.D.

Translation by E. T. LEDDY, M.D., Mayo Clinic.

ELECTROSURGERY (Die Elektrochirurgie). By PROF. DR. FRANZ KEYSSER. With 232 illustrations in the text and 6 colored figures in 2 tables; 238 pages. Published by Fischer's medizinische Buchhandlung, Leipzig, 1931. Price, paper, 52 marks; bound, linen, 56 marks.

This book, handsomely made up and containing many instructive illustrations, opens a relatively new territory. It fills a long-felt want, for it, as the first in the field, gives a comprehensive consideration of the modern development of electrosurgery. The technic worked out by the author, the ap-

paratus that has been developed, the detailed methods of its application, are described in full, and theoretic and physical concepts, usually of such little attraction for the physician, have been cut to the necessary minimum.

In the application of electrosurgical methods, the electric knife is used as an ordinary scalpel. In the main body of the book, the clinical part, the author demonstrates that otherwise inoperable, hopeless cases of tumor, previously irradiated in vain, may be healed for more than three years by this procedure, and that even operable tumors may be successfully treated by electrosurgical methods. Keysser points out in detail the field of usefulness of this method, gives the indications for electrosurgery, and shows the course of treatment by illustrating its use in malignant tumors arising in all parts of the body. A concluding chapter takes up the biologic considerations of inoperable tumors and points out the methods of increasing the body powers of defense against malignant disease. One is impressed by the number of illustrations of successfully treated cases.

F. HAENISCH, M.D.

Translation by E. T. LEDDY, M.D., Mayo Clinic.

ATLAS OF ROENTGENSTEREOSCOPY (Atlas der Röntgenstereoskopie). By MAX COHN. First series, with 20 prints and a viewing device. Published by Georg Thieme, Leipzig, 1931. Price, 22 marks in a linen cover. A small carton contains a demountable viewing device, a collection of 20 prints of clinical subjects, and a booklet describing the views.

The atlas is a supplement to the text-book by Cohn and Barth on roentgenstereoscopy, brought out by the same publisher. It is designed to present useful plastic pictures of the various aspects of medical roentgen-

ology so that the observer may have the concept of seeing the actual objects.

F. HAENISCH, M.D.

Translation by E. T. LEDDY, M.D., Mayo Clinic.

RESULTS OF MEDICAL RESEARCH IN RADIATION: ROENTGEN DIAGNOSIS—ROENTGENOTHERAPY, RADIUM THERAPY, AND ACTINOTHERAPY (Ergebnisse der Medizinischen Strahlenforschung: Röntgendiagnostik—Röntgen, Radium, und Lichttherapie). Edited by H. HOLFELDER, H. HOLTHUSEN, O. JÜNGLING, H. MARTIUS, and H. R. SCHINZ. Volume V. With 396 illustrations in the text. Published by Georg Thieme, Leipzig, 1931. Price, 72 marks; bound, 74.50 marks. Subscription price with the previous volumes, 64.80 marks; bound in calf, 67.50 marks.

This fifth volume takes an honored place among its predecessors. No less than ten monographs report the present status of the science in the various fields of research.

In a short consideration of cascade stomach, Regelsberger, from the Medical Clinic at Erlangen, advances the view that it is a symptom of psychoneurosis. Anacidity and spastic obstipation are often associated with cascade stomach. Hyperacidity means ulcer formation. Pansdorf, of Frankfurt, writes a rather long experimental study on the roentgenology of the small intestine. O. Risse, of Freiberg, takes up the physical fundamentals of photochemistry (light and roentgen rays). After a discussion of the fundamental laws, he takes up the reciprocal action of light and matter, and the process of absorption, and then the essentials of the chemical effects of optical light and of X-rays. An exhaustive article by Timofieff-Ressowsky, of Berlin, takes up the subject of radiogenetics; then Baensch, of Leipzig, reports the roentgenotherapy of hypophyseal tumors. The results of radiation certainly justify a trial with this agent before operation. Hal-

berstaedter and Simons conclude from their results in treating skin cancer than almost all early skin cancers are curable by radiation. A follow-up, lasting for years, is very important. A paper from Holfelder's Institute considers the treatment of struma maligna. Very instructive is the paper by Schinz and Uehlinger on the diagnosis, differential diagnosis, prognosis, and treatment of the primary tumors and cysts of the osseous system. Zwerg, of the surgical clinic in Königsberg, writes about radium surgery. The closing article is by Friedrich and Schreiber, of Berlin, on the technical fundamentals of light analyzed spectrally.

An index of subjects and authors is to be found at the end of the book and each chapter is followed by a citation of the literature. The reproduction of the figures in the text is excellent, and the make-up, paper, etc., are first-class.

F. HAENISCH, M.D.

Translation by E. T. LEDDY, M.D., Mayo Clinic.

ROENTGEN DIAGNOSIS AND THERAPY IN DENTISTRY (Die Röntgendiagnostik und Therapie in der Zahnheilkunde). By O. LOOS, and G. GABRIEL. With 22 illustrations in the text and 257 illustrations, 20 in photographic and 19 in autotype reproduction. Radiologische Praktika, Volume XVI. Published by Georg Thieme, Leipzig, 1931. Price 36 marks.

The first two chapters, written by Gabriel, take up the technic of exposure in dental radiography and roentgenotherapy in dentistry. Loos wrote the larger third chapter, which is on roentgen diagnosis. It occurred to the author that very frequently in the literature on dental roentgenology considerable confusion is caused by the terms "Aufhellung" and "Abschattung" and he has, therefore, introduced two new terms, "radiolucent" and "radioopak," to both of which I sincerely wish a very short

life. There should be no mistaking the findings in a roentgen negative, that is, in the original film or in those seen in the print.

Aside from this, I welcome the appearance of this book. There are few good books on dental roentgenology. The wealth of illustrations, particularly the reproductions on numerous plates, makes the book especially valuable to those taking up dental roentgenology. The roentgenologist who has been in this field for a longer time will find much information in the text. This book will be popular, just as it should be.

F. HAENISCH, M.D.

Translation by E. T. LEDDY, M.D., Mayo Clinic.

ROENTGEN EXAMINATION OF THE GALL BLADDER (Röntgendiagnostik der Gallenblase). By F. EISLER and G. KOPSTEIN. Radiologische Praktika, Volume XVII. With 151 illustrations. Published by Georg Thieme, Leipzig, 1931. Price, 18.60 marks.

The authors have taken upon themselves the task of writing a consistent presentation of the subject of roentgenologic examination of the gall bladder. In this they have tried, in spite of the far-reaching importance of cholecystography, to evaluate correctly the precholecystographic era. Since Eisler and Kopstein can draw on their own experience from several thousand examinations, it is natural that critical opinions should be voiced throughout the text. They point out the many drawbacks to the method of examination and its results as carried out at that time. They use the oral method almost exclusively; clinical control is carried out as completely as possible.

The material is dealt with in a fundamental and comprehensive way, first the anatomic and physiologic foundations which give a better understanding of cholecystography are presented, and then the technical methods of the procedure are ex-

plained in detail. In the chapter on symptomatology, the present status of our knowledge is discussed in detail and some remarks on probable sources of error are included. The reviewer, who has devoted many hours to the study of the gall bladder, thoroughly enjoyed reading this book.

The reproductions in the book are excellent and the make-up of the volume is in complete accord with the high standards of the publisher.

F. HAENISCH, M.D.

Translation by E. T. LEDDY, M.D., Mayo Clinic.

NORMAL AND PATHOLOGIC FUNCTION OF THE ORGANS OF DIGESTION AS SHOWN IN THE RADIOGRAPH (Normale und pathologische Funktionen der Verdauungsorgane im Röntgenbild). By R. BECKER and A. OPPENHEIMER. With 255 illustrations; 144 pages. Published by Georg Thieme, Leipzig, 1931. Price, 16.75 marks; bound, 18.75 marks.

In the radiograph, the authors have studied changes in the motility of the organs of digestion in normal and pathologic conditions. They illustrate how the various processes of digestion are accompanied by definite motor phenomena in which transportation and digestion can be differentiated. The movement of the mucous membrane is quite independent of that of the musculature. The motor phenomena of the esophagus, stomach, small and large intestines, and the gall bladder are discussed in separate chapters and the various important points are illustrated by radiographs. By these anatomic considerations, roentgen diagnosis is made to progress into clinical morphology. Many excellent figures illustrate the interesting text.

F. HAENISCH, M.D.

Translation by E. T. LEDDY, M.D., Mayo Clinic.

ROENTGENOLOGY OF THE URINARY TRACT (Die Harnorgane im Röntgenbild [German]. Radiographie de l'Appareil Urinaire [French]. Los organos urinarios en la radiografía [Spanish]). By EUGEN JOSEPH and S. PERLMANN. Second enlarged and revised edition. With 33 sketches in the text, 3 colored plates, and 336 radiographs on 124 tables. Supplementary volume XXXVII of Archiv der Normalen und pathologischen Anatomie in typischen Röntgenbildern. Published by Georg Thieme, Leipzig, 1931. Price, 58.50 marks; bound, 64 marks.

The second edition of Joseph's book, which first appeared in 1926, lies before us. It is really a new presentation of the material. The text has grown from 56 to 86 pages; the somewhat terse presentation of technic is enlarged; the introduction to the symptomatology of diseases of the urinary tract in their relationship to roentgen diagnosis has been expanded; and at the end a new section has been devoted to intravenous pyelography. As for the historical side of the latter, it seems to me, if my information is correct, that Swick deserves greater credit, for it was he who discovered the contrast effect in the urinary tract. In this new edition, Joseph still more or less opposes pneumoperitoneum and pneumoroentgenography of the kidney and pneumopericystography.

The second portion of the book is more than double the size of the original 153 illustrations and 38 tables. In 124 plates there are presented 336 radiographs, mostly pyelograms. In extraordinary variety the kidneys, ureters, and bladder are presented in the normal as well as in the various rare abnormal forms. The extensive atlas gives one a clear picture of the efficiency of pyelographic methods and at the same time makes one appreciate how difficult interpretation may be in order to avoid the frequent possibilities for error. A study of this book may be warmly recommended to any phy-

sician who is at all concerned with urologic diagnosis. The text following the illustrations is in German, English, French, and Spanish. The make-up of the book is first-class.

F. HAENISCH, M.D.

Translation by E. T. LEDDY, M.D., Mayo Clinic.

INTRODUCTION TO THE ROENTGENOTHERAPY OF SURGICAL DISEASES (Einführung in die Röntgentherapie chirurgischer Erkrankungen). By J. PALUGYAY. Radiologische Praktika, XVIII, 103 pages. Published by Georg Thieme, Leipzig, 1931. Price, 10 marks.

This book is of special interest to the general man who wants to get an idea about the usefulness of roentgenotherapy in surgical diseases. For that reason the author goes into the technical aspects of treatment only as far as is necessary to enable one to comprehend its principles. Palugyay's experience is based on a wealth of clinical material so that his presentation is fluent, yet it carefully avoids any over-optimistic emphasis of the subject.

The subject matter is considered under the following headings: (1) specific and non-specific inflammations; (2) benign and malignant tumors of the various body structures; (3) goiters, and (4) various special indications for radiotherapy such as the arthritides, fractures, arrest of hemorrhage, gastric ulcers, etc. He sets his skin unit dose at 560 r.

The text is not burdened with a load of authors' names and discussions of priority; for that reason, there is at the end a rather extensive citation of the literature, for a book of this type. This little volume is warmly recommended to those who wish to become oriented in this extensive field.

F. HAENISCH, M.D.

Translation by E. T. LEDDY, M.D., Mayo Clinic.

ROENTGEN EXAMINATION OF THE ALIMENTARY TRACT, INCLUDING THE LIVER AND BILE PASSAGES (Die Röntgendiagnostik des Verdauungskanal). By H. W. ALBRECHT. With an introduction by Professor F. VOLHARD. With 828 illustrations; 493 pages. Published by Georg Thieme, Leipzig, 1931. Price, 56 marks; bound, 59 marks.

This exhaustive work leaves almost nothing unsaid about the development of the roentgen examination of the gastro-intestinal tract and its most recent status. In separate chapters the esophagus, the stomach, the duodenum, the small intestine, the appendix, and the large intestine are considered: in each case the anatomy, the physiology, the methods of examination, the clinical symptoms, and roentgenologic signs of the various pathologic affections are considered in detail and illustrated by first-class reproductions of radiographs. The modern developments in the study of the mucosal relief are emphasized repeatedly. The close collaboration with the surgeon and pathologist increases the value of the book. Two chapters are devoted to the roentgen examination of the liver and bile passages, in which, naturally enough, both cholecystography and the older roentgen signs are given special consideration. At the end of the chapters there is an extensive bibliography; at the end of the book there is a table of contents.

This fine work deserves a place in every roentgenologist's library but any interested physician may well study it with profit. The last three paragraphs of the introduction by the internist Volhard will fill all roentgenologists with special joy because they grant to roentgenology fullest and most gracious recognition as a specialty.

F. HAENISCH, M.D.

Translation by E. T. LEDDY, M.D., Mayo Clinic.

MALIGNANT TUMORS OF THE PHARYNX AND LARYNX (Maligne Pharynx und Larynxtumoren). By A. ZUPPINGER. The experience of the Zurich Clinic; with an introduction by R. H. SCHINZ. With 33 illustrations in the text and 9 tables, 188 pages. Supplementary volume XL to the *Archiv und Atlas der normalen und pathologischen Anatomie in typischen Röntgenbildern*. Published by Georg Thieme, Leipzig, 1931. Price, 28 marks; bound, 30 marks.

The definitely better results which have been obtained recently by means of Coutard's protracted-fractionated method of irradiation than by the older procedures in treatment of malignant tumors of the pharynx and larynx furnished the idea of collecting statistically the Zurich material for the years 1919 to 1928 and of giving an unbiased evaluation to the results obtained by surgical and radiotherapeutic treatment in this group.

After some short introductory remarks on the pathologic and anatomic classification and degree of advancement of these cases, there follows a comprehensive review of 280 cases seen in the Zurich clinics with a detailed analysis of results. The results show that, as it was usually carried out, radiotherapy failed, that the palliative effects were poor, and that the damages from treatment were far too high. Perhaps a number of the cases were hopeless when they came to the clinics. Schinz thinks that these failures are important because one can learn much from them, and that they will furnish a basis for comparison with results obtained by improved technics. In conclusion, the principles of future methods of treatment of malignant tumors of the larynx

and pharynx are outlined, the protracted-fractionated method being regarded as a definite step of progress.

The book contains much instructive detail and many important observations such as is possible only when a wealth of material like this is carefully and thoroughly reviewed.

F. HAENISCH, M.D.

Translation by E. T. LEDDY, M.D., Mayo Clinic.

ROENTGEN INVESTIGATION OF THE MUCOSAL RELIEF OF THE ALIMENTARY CANAL (Röntgenuntersuchungen am Innenrelief des Verdauungskanal). By H. G. BERG. A contribution to clinical roentgen diagnosis, especially of inflammations, ulcer, and cancer. Second edition. Illustrations, 247; pages 248. Published by Georg Thieme, Leipzig, 1931. Price, 30 marks; bound, 32 marks.

This second edition, appearing one and one-half years after the first, is an indication of the favorable reception which this book has had. The text has been amplified in many places, as the presentation has been made more extensive. Fifty-four illustrations have been added, and the number of pages has been increased by fifty. The exposition of the relief changes in the stomach following operation has been enlarged in a noteworthy manner, and gastritis and edematous conditions about the anastomosis (jejunitis), as well as investigation of the large intestine, are discussed. Like the first, the second edition is very well done.

F. HAENISCH, M.D.

Translation by E. T. LEDDY, M.D., Mayo Clinic.

ABSTRACTS OF CURRENT LITERATURE

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APPARATUS

A New Type of Measuring Instrument for Roentgen Rays, Especially for Grenz Rays. Rudolf Thaller. *Strahlentherapie*, 1931, XLI, 332-335.

A tellur-selenium photo-electric cell suitable for the measurement of X-rays of long wave length is described. A simple galvanometer serves as a recording instrument. The response of the cell changes with the temperature; from 15° C. on the current decreases about 1.5 per cent per degree. The apparatus can be calibrated in r. The author emphasizes its simplicity of construction and operation.

ERNST A. POHLE, M.D., Ph.D.

An X-ray Film Projector: A Preliminary Report. H. C. Nott. *Med. Jour. Australia*, July 18, 1931, II, 79.

An apparatus is described for the projection of original full-size radiographs on a screen for viewing by large audiences. The use of lantern slides is undesirable as these have the disadvantage of expense and loss of detail and increase of contrast as compared with the original films.

J. G. STEPHENS, M.D.

The Philips-Metalix Skin Therapy Apparatus: A Step towards Standardization of Radiation Technic in Skin Therapy. F. Bödecker and R. du Mesnil de Rochemont. *Strahlentherapie*, 1931, XLI, 296-304.

The apparatus described by the author is built especially for superficial therapy and has a fixed potential of about 45 kilovolts. At 20 cm. F.S.D., the output is approximately 54 r per minute for unfiltered radiation. For Al filtration the output is reduced, depending upon the thickness of the filter. At 4 mm. of Al it is, for instance, 1.9 r per minute. Measurements show that a filter of 0.7 mm. Al resulted in the production of a radiation as used by the authors for many years in skin therapy.

It is suggested, therefore, that this filter be attached to each apparatus permanently to furnish a calibration to the physician. Since tests have convinced the authors that changes of the output are not more than plus or minus 4 per cent over a long period of time, due to a mechanism built in the transformer, they recommend this model to the dermatologist.

ERNST A. POHLE, M.D., Ph.D.

Studies on a Light Source of Radiant Heat. Leopold Freund and Friedrich Lauscher. *Strahlentherapie*, 1931, XLI, 519-530.

This is a detailed report of the authors analysis of the "Sunny long wave depth radiator," a lamp designed for the application of radiant heat.

ERNST A. POHLE, M.D., Ph.D.

BLADDER

Cardinal Facts Relating to Vesical Neoplasm, with Case Reports. Charles H. Chetwood. *Urol. and Cutan. Rev.*, August, 1931, XXXV, 477-483.

The author is of the opinion that all bladder growths should be considered potentially malignant, and that hematuria, the predominant and most constant symptom, should always lead to a thorough investigation. No method of treatment affords a guarantee of permanent elimination of any bladder growth, for similar cases will react in a different manner to the same type of treatment.

The methods of attack upon neoplasms of the bladder employed at the present time are as follows:

1. Transurethral destruction by the high frequency electric current.
2. Open operation through a suprapubic incision and removal of the growth by excision, desiccation, or surgical diathermy.
3. Excision of the growth together with a part of the bladder wall.
4. Destruction by radium units applied either transurethrally or through a suprapubic wound following previous surgical removal of the growth.

As no rule can be laid down to fit all cases, it is considered necessary to study each case carefully and to treat it individually. However, simple papillary growths, as diagnosed clinically and by biopsy, when possible, should be given the high frequency current transurethrally at first. A recurrence of the same growth may be similarly attacked. Persistent recurrence, however, calls for more radical measures as does a change in the pathology involving malignant transformation.

The insidious character of cancer renders diagnosis and prognosis extremely difficult. The question of diagnosis of the vesical growths, however, is a more simple one on the whole than that of prognosis. Since hematuria is usually the primary symptom in these cases, it is of utmost importance that every case presenting this symptom be carefully investigated.

The author reports a series of nine cases of bladder growths, illustrating the various methods of treatment that may be employed.

J. N. ANÉ, M.D.

BONE (DIAGNOSIS)

Derangement of the Menisci of the Knee Joint: A Report of an End-result Study of 142 Cases Treated by Operation. Leonidas A. Lantzounis. *Surg., Gynec. and Obstet.*, August, 1931, LIII, 182-188.

The onset of symptoms was related to injury of varied severity. In two-fifths of the cases the injury occurred while the patient was engaged in some athletic sport. The most flexion is the most favorable position for injury to the menisci, the severity of the injury seeming not to have any bearing upon the pathologic findings. The most constant symptom was pain with a definite history of injury and was referred to the medial or lateral aspect of the joint corresponding to the side of the injured meniscus.

Swelling was a constant symptom. Locking of the joint was present in but 56 per cent of the cases and slipping of the joint in 43 per

cent, weakness or instability of the joint in 37 per cent. The area of tenderness is usually well localized and is best determined by examining the knee in the semi-flexed position. It was found in 85 per cent.

Palpation of the displaced meniscus is a rare finding. Slight limitation of extension was not common, while limitation of motion was found in 43 per cent. Crepitation was present in 37 per cent and usually in the recurrent cases.

The radiographic findings have very little positive diagnostic value, but the radiograph is valuable in excluding loose bodies, fracture of the tibial spine or tuberosities, osteochondritis dissecans, and calcification of the infrapatellar fat pad. Also, the radiograph was of diagnostic value in showing an unbalanced joint space.

Surgery is the treatment advocated, and the post-operative treatment is discussed. In the series of 142 knees operated on, among 139 patients, there were no operative deaths and no cases of post-operative infection of the knee joint. In 85 per cent, the results were excellent; in 15 per cent, good.

Abstractor's comment: The author should be highly complimented upon the results which he reports, but perhaps these would be better understood if we knew his interpretation of the words "excellent" and "good."

DONALD S. CHILDS, M.D.

BONE DISEASES (DIAGNOSIS)

About Chondromatosis. Vilma Schratzenbach. *Röntgenpraxis*, Sept. 1, 1931, III, 776-784.

Chondromatosis of the skeleton is found in young children; most often it is multiple and the course is markedly chronic. Such a case, in a four-year-old child, is described. Multiple chondromas were discovered by roentgen examination, the roentgen film being characterized by roundish, well-circumscribed, partially confluent areas of destruction, which sometimes showed calcified trabeculae. The

surrounding bones showed no reaction. Very often these tumors are found in the diaphyses of the small bones of the feet and hands; however, other bones are also frequently involved.

Chondromatosis of the joints presents an entirely different picture. It is found most commonly in men between the ages of twenty and fifty years. Usually only one joint is attacked, most often one of the larger ones (knee, elbow, or hip). In addition to cartilaginous tumors of small or large size, free joint-mice may also be found in the joints thus affected. The roentgenologic diagnosis is made possible by the deposition of calcium in these tumors. The case described showed a large chondroma, the size of a fist, in the left hip joint, which was diagnosed chondroma by biopsy. Surgical excision was not thought advisable and X-ray therapy had no result. An increasing cachexia and the peculiar roentgenologic appearance must make one think of a sarcomatous degeneration.

H. W. HEFKE, M.D.

A Case of Kienböck's Disease. W. J. Paterson. Can. Med. Assn. Jour., July, 1931, XXV, 77, 78.

The condition known as Kienböck's disease is one of considerable rarity, but, owing to its importance from a standpoint of diagnosis and also from its important relation to the Workmen's Compensation Act, the author cites the case.

A laborer, engaged by a local firm, had worked but three hours when he reported an accident. He said that while assisting a fellow workman to lift some planks, his partner dropped his end of the plank, causing it to fall and hurt his wrist. Examination showed a swollen wrist with painful, impaired movement. There was tenderness over the semilunar bone of the wrist. The condition was so slight that an X-ray examination was not made. A diagnosis of sprain was made and the wrist strapped.

Five days later an X-ray examination was made and showed a destructive lesion of the

semilunar bone of the wrist, with an old fracture. The wrist was splinted and the employers notified that the disability was not due to the accident but to disease which had been present some time prior to the accident.

Three months later another X-ray was taken, which showed a condition so similar to the first one that the films could be actually stereoscoped.

The man appealed the case for compensation to the Workmen's Compensation Board, but the Board accepted the diagnosis of Kienböck's disease.

The author states that he can find only four references in the literature to this condition since Kienböck first described it, in 1910. It is apparently a rarefying osteitis of the semilunar bone which has been variously attributed to either interference with the circulation of the bone, or to repeated small traumas. In either case, the condition results in necrosis of the bone, fragmentation, and, later, fracture.

The symptoms are: Pain in the region of the semilunar bone, sometimes felt while at rest, but more often while in motion; tenderness over the semilunar, and slight to moderate swelling over the wrist.

The signs that may help in the diagnosis are: (1) The head of the third metacarpal bone is on the same level as that of the second and fourth metacarpals, whereas normally it is more prominent. This alteration is due to the destruction of the semilunar, which allows the metacarpal to be displaced upward slightly toward the wrist joints; (2) pain may be elicited over the semilunar bone by tapping on the head of the third metacarpal with the fist closed and the hand held in ulnar deflection. As regards function, it is usually noted that pronation and supination are good, whereas flexion and extension are limited. Pushing with the hand is impaired and power at the wrist is also limited.

The diagnosis is made chiefly on the characteristic X-ray appearance, which remains unchanged over long periods, while the rest of the wrist bones remain unaffected. The chief differential diagnosis is from sprains or chronic arthritis of the wrist.

The prognosis is good. The course of the disease is very slow and is subject to periods of remission and exacerbation. These latter periods are the result of minute trauma which would not affect a normal wrist.

Nothing very beneficial is known regarding treatment. Rest and splinting have been advised, and even removal of the semilunar has been recommended. At the same time, a normal wrist could hardly be the result, whereas the original disability might be very slight over a period of years.

L. J. CARTER, M.D.

Bone Infections from the Standpoint of Roentgen Interpretation. Sydney E. Johnson. *Kentucky Med. Jour.*, August, 1931, XXIX, 392, 393.

The author says that the most frequent type of bone infection is acute pyogenic osteomyelitis. The most important fact regarding the X-ray findings in connection with this is that there are none, the examination being negative; however, the early examination is justified, because there is always the chance that visible bone changes may have taken place, and the examination will often show or exclude some other condition. After from five to ten days the X-ray examination will have a high degree of accuracy.

W. W. WATKINS, M.D.

About the Roentgenologic Diagnosis and Operative Treatment of the So-called Brodie's Abscess. D. Goldstein and S. Kurbangalejew. *Röntgenpraxis*, Aug. 15, 1931, III, 759-766.

Just one hundred years ago the English surgeon, Sir Benjamin Brodie, described a peculiar type of localized osteomyelitis. A comparatively small number of such cases has been described in the literature. Two cases are presented.

Characteristic of such a bone abscess is its localization in a long bone (usually close to a joint), the round, oval, or regular shape of the cavity, and the absence of sequestration. The differential diagnosis has to be made from a gumma, tuberculosis, or a cyst. Surgery is

the only treatment. This disease seems to be more frequent than one is usually led to believe.

H. W. HEFKE, M.D.

Osteochondritis Deformans Juvenilis. S. R. Cunningham. *Jour. Oklahoma Med. Assn.*, January, 1931, XXIV, 13, 14.

X-ray findings may be divided into four stages: (1) Stage of flattening, with increased density and diminution in size of bony nucleus; (2) stage of fragmentation, bony nucleus showing irregular calcification, appearing to be broken up, with cartilage spreading laterally; (3) stage of repair, when fragments coalesce, become uniform, and increase in size; (4) stage of moulding of the reformed femoral head, which continues until adult life, when either a cap or a mushroom deformity persists, shortening of the neck resulting.

The disease needs to be differentiated from tuberculosis of the hip and coxa vara, but the X-ray appearances are distinctive and differentiation is not difficult.

W. W. WATKINS, M.D.

THE BRAIN

Traumatic and Inflammatory Brains, with Pneumographic Demonstration of Some After-results. Charles R. Rayburn. *Jour. Oklahoma Med. Assn.*, January, 1931, XXIV, 1-8.

This is a report of the use of pneumography in certain intracranial conditions met with in a hospital for the insane. The following points are stressed: (a) Study the patient and know when to use ventriculography and when to use encephalography, as each has its indications; (b) ventriculography is used as a last resort and only by an experienced brain surgeon; (c) encephalography should be done with caution in any organic condition suggesting tumor or marked intracranial pressure, and should not be done when the fluid pressure is over 20 mm. of mercury nor when the

symptoms indicate that a lesion (tumor) exists within the posterior part of the third ventricle, the aqueduct of Sylvius, the fourth ventricle, cerebellum, peduncles, pons or medulla; (d) constant pressure of the fluid should be maintained; (e) know the normal contour of the cerebrospinal fluid spaces; (f) be sure the entire fluid spaces are filled with air. All head injuries should be considered dangerous and the treatment instituted should be designed to prevent future symptoms developing, and to this end (a) disturb the patient as little as possible, (b) be in no hurry about X-ray films, (c) elevate the head of the bed, (d) ice caps to the head, (e) spinal drainage as needed, (f) limitation of fluids and dehydration by magnesium sulphate and glucose.

W. W. WATKINS, M.D.

CANCER (DIAGNOSIS)

Examination of Cancer Tissue in Fluorescent Light. Juraj Körbler. *Strahlentherapie*, 1931, XLI, 510-518.

The author investigated the possibility of differentiating normal and cancer tissues by fluorescence. As a light source he used a carbon arc with nickel filter transmitting chiefly 3,650 Å., and also small quantities of 4,040 Ångströms. It appeared that in a photograph taken in ordinary light cancer tissue could not be distinguished from normal tissue. In a fluorescent photograph, however, it showed as a brilliant spot. This method could, perhaps, be developed for the diagnosis of cancer without biopsy in body cavities, as, for instance, the larynx. A number of photographs are appended demonstrating the author's observation.

ERNST A. POHLE, M.D., Ph.D.

CANCER (THERAPY)

Laryngofissure in Cancer of the Larynx. Sargnon. *Le Cancer*, 1930, VII, 151-155.

The author recommends laryngofissure, followed by the insertion of a tube of 50 micro-

curies of radium wrapped in gauze. The tube is inserted into the thyrotomy wound and left for twenty-four hours at a time. In cases in which the radium is badly tolerated, X-rays are applied instead. He claims 80 per cent of cures for this method, but gives no detailed statistics.

WALTER M. LEVITT, M.R.C.P., D.M.R.E.

Results of Roentgen Therapy of Carcinoma of the Breast. H. Wintz. *Deutsche med. Wchnschr.*, 1931, LVII, 1569-1573.

The author has analyzed the cases of carcinoma of the breast treated by irradiation in his clinic during the last 15 years, presenting the results in statistical form. In determining the stage of the disease, he has used the classification of Steinthal.

Stage I refers to tumors confined to the breast only, which are freely movable and not attached to the skin or underlying structures, and in which no axillary or supraclavicular glands are palpable. Stage II includes tumors which have grown into the major part of the breast, are attached to the skin, with glands palpable in the axilla. Stage III covers tumors in which most of the breast is invaded by the neoplasm, which is attached to skin and underlying structures, with supraclavicular glands present. To a fourth group belong all cases with distant metastases.

In the statistics, the cases belonging to Stages I and II are combined. Ninety-seven patients were treated, 75, or 77.3 per cent, of whom were free of symptoms and able to work three to four years following the treatment. Forty-six out of 83 patients, or 55.4 per cent, were well five to six years following the treatment. Twenty-eight patients out of 70, or 40 per cent, were well eight to nine years after the treatment. Fifteen patients out of 49, or 30.6 per cent, were well nine to eleven years after treatment. If Stages I and II are analyzed separately, the percentage of cures is, of course, much higher for Stage I. For instance, 10 patients out of 16 belonging to Stage I were well 10 to 11 years after the treatment, i.e., a total of 62.5 per cent. The

corresponding figure for Stage II was 15 per cent.

All cases were confirmed by biopsy. As a rule, in from 4 to 8 days following the irradiation the tumor was removed for histologic examination. If glandular metastases were present, these only were removed in most cases. During the past three years, all these surgical measures were carried out by the endotherm knife.

In Stage III, which includes the inoperable cases, the results were also encouraging. Seventeen out of 81 patients, or 21 per cent, were well three to four years following the treatment. Seven patients out of 69, or 10 per cent, were well five to six years after the treatment. Five cases out of 50, or 10 per cent, were well eight to nine years after the treatment.

The entire number of cases representing recurrences following operation is also analyzed. Sixty-eight out of 211 cases, or 32.2 per cent, were well three to four years after the treatment. Thirty-three patients out of 177, or 18.47 per cent, were well five to six years following the treatment. Sixteen patients out of 136, or 11.7 per cent, were well eight to nine years after treatment. Seven patients out of 103, or 6.8 per cent, were well ten to eleven years after treatment. If the entire hopeless cases are deducted from this group, then the percentage of cures is considerably increased. For the last group, for instance, with 6.8 per cent of cases free of symptoms ten to eleven years after treatment, the figures change to 7 patients out of 51, or 13.7 per cent well.

The procedure in treating these patients is related in detail. The breast, axilla, and supraclavicular areas are mapped out and subdivided into a number of fields, each of which receives from 100 to 105 per cent erythema dose. In order to get this dose into the entire axilla, it is necessary to add a posterior field. A second treatment is usually not considered before from eight to nine weeks. Sometimes the interval is as long as from five to seven months. The irradiation in post-operative cases is carried out similarly. No attention is paid to the variations in the radiosensitivity of the various types of carcinoma; in the

author's opinion, medullary carcinoma is probably 15 per cent more susceptible than adenocarcinoma. Very important is the after-care, where everything must be done in order to increase the general resistance of the patient. In all cases roentgen sterilization is carried out as a routine measure.

If the results obtained by irradiation in Stage I are compared with the results following surgery, it must be admitted that irradiation therapy cannot do better than surgery. However, in Stages II and III, irradiation is superior to operation.

ERNST A. POHLE, M.D., Ph.D.

A Case of Cancer of the Breast Treated with Radium and X-rays. S. Gilbert Scott. *Lancet*, Aug. 8, 1931, CCXXI, 292, 293.

The author presents a case of carcinoma of the right breast with metastases to the thorax and palpable glands in the supraclavicular fossa. The patient also had a uterine fibroid of about the size of a six-months' pregnant uterus. A radical mastectomy was considered as was also surgical removal of the fibroid, but the patient was not operated upon because of the thoracic metastases; also removal of the fibroid would be of small benefit.

It was decided to use radium needle implants in the breast tumor and supraclavicular glands, this to be followed by X-radiation, using the saturation technic.

Ten days after the radium implantation, the trunk was divided into two radiation fields, thoracic and abdominal, and the dose brought up to the point inducing slight nausea. This radiation was given even though there was considerable local reaction present from the radium radiation. Following this radiation, the breast returned to its normal consistency, the supraclavicular glands were not palpable, and the thoracic metastases no longer apparent. The fibroid shrunk to the size of a base-ball.

According to the author, the saturation method is the utilization of medium wave lengths with light filtration, having for its object the absorption of a large number of heterogeneous rays. The dose can be administered

by this method over large areas without danger of severe constitutional disturbance.

The author believes that short wave technic, whether by radium or X-rays, is not applicable in prophylaxis, because this method is the local delivery of a large quantity of homogeneous rays, calculated to deliver a certain dose at a pre-arranged depth. It is the author's belief that his method is the only logical way to radiate with the object of prophylaxis.

F. L. GRANDSTAFF, M.D.

Cancer of the Cervix after Subtotal Hysterectomy. L. Delporte and J. Cahen. *Le Cancer*, 1930, VII, 215-228.

The investigation showed that in ten cases only three could be considered as having developed after the operation, the other seven cases representing, in fact, misdiagnoses at the time of the original operation. In order to obviate such mistakes, the biopsy should include snippings from the cervix, the cervical canal, and the interior of the body of the uterus. Of the ten cases, four are reported cured—two for over seven years, and two for over two years.

In discussing the method of treatment of carcinoma of the cervix, the authors recommend vaginal or cervico-vaginal application of radium. They consider that the superiority of telecurietherapy has not been demonstrated. Deep X-ray therapy, they consider, has only a transient beneficial effect. The actual technic favored appears to be the insertion of three ten-milligram tubes of radium, one in the cervix and one in each fornix. These are left in for about ten days, the total dosage delivered being about 35 millicuries destroyed. However, prime importance is not attached to the form of the containers, so long as the quantities and dosage are correct.

WALTER M. LEVITT, M.R.C.P., D.M.R.E.

Our Progress in the Treatment of Breast Cancer by Post-operative Irradiation: The Tangential Treatment Method. A. Hintze. *Strahlentherapie*, 1931, XLI, 601-646.

This, a very important paper, deals with

the efficacy of post-operative irradiation in cancer of the breast. The paper, which should be studied in the original by all interested in the treatment of this disease, is based on the analysis of cases seen in the Surgical Clinic of Professor Bier, University of Berlin.

In the first chapter, the author reviews briefly the development of post-operative radiation therapy in breast cancer, and follows by an outline of the statistical method used in compiling his own clinical material. During 1912 to 1930, 310 patients received post-operative X-ray therapy, 417 were only operated on, 322 cases with recurrences received X-ray therapy, and 25 cases with distant metastases were also treated by X-rays. This amounts to a total of 1,074 cancer of the breast patients. In 95 per cent of these cases, a complete follow-up was possible. Besides these, 22 patients who had been operated on before 1912 were treated by X-rays. In a total of 1,206 treated women, 110 were not operated on (104 inoperable, 6 operable but only irradiated) and 1,097 were operated on.

In order to judge the value of post-operative irradiation, the percentage of survivors 5 years after the treatment was calculated. There were available 183 patients operated on and irradiated, 367 operated on only, 274 irradiated because of recurrence, and 15 irradiated because of distant metastases, or 656 cases not irradiated for prophylactic purposes, giving a total of 839 "five-year cases" for the period of 1912-1925. Of these 839 patients, 295, or 35.1 per cent, were alive at the end of five years. However, for the post-operatively irradiated cases, 97 out of 183, or 53 per cent, remained well, while of the cases only operated on, 198 out of 656, or 30.1 per cent, were alive. In other words, the prophylactic post-operative irradiation improved the five-year results about 100 per cent. This includes all cases regardless of whether they were operated on in the author's own clinic or elsewhere.

Taking only those patients who were operated on in the author's clinic, the figures are as follows: 538 patients only operated on, of these, 161 alive after 5 years, or 30 per cent; 76 cases out of 137 operated on and irra-

diated cases alive after five years, or 55 per cent. The statistical analysis of these cases is shown in graphic form.

The author then discusses the influence of stage of disease, age of patient, and histologic character of the tumor on the end-result. Colloidal carcinoma responded relatively well. Adenocarcinoma was not so favorable. Much less favorable were medullary and one type of scirrhus carcinoma, while another type of the latter appeared to be less malignant.

In the fourth chapter the X-ray treatment method developed by the author is described in detail. Its principal point is the use of tangential fields in order to avoid long reactions. A number of illustrations show the application of the various fields. As a rule, 500 r are given per field so that the entire first series is finished in three days. The second series follows six weeks later. Six to eight weeks after the second, the third and last series is given. From then on the patients are examined at regular intervals, at least twice a year.

In a concluding chapter, the deductions to be made from this study are presented. It culminates in the sentence, "It is the duty of every physician to advise post-operative irradiation of breast cancer!"

In an appendix are compiled statistics from the world literature, based on those authors who have operated on at least 100 cases. They show that, with operation alone, 1,408 out of 4,952 patients are alive after five years (28.4 per cent) and 17.3 per cent of the same group after 10 years. Out of 2,822 who were operated on and irradiated, 1,070 patients were alive after 5 years, corresponding to 37.9 per cent, and 22.1 per cent were alive after 10 years. This also shows a very definite improvement of the end-results due to post-operative prophylactic irradiation.

ERNST A. POHLE, M.D., Ph.D.

A New Method of Treating Cancer of the Cervix. Eugene S. Auer. *Jour. Missouri St. Med. Assn.*, June, 1931, XXVIII, 257-259.

This author describes a new technic of radium application designed by Gellhorn and, so

far, used on eleven cases at the Barnard Free Skin and Cancer Hospital in June and July, 1930. It consists in surrounding the tumor by radon seeds by the intra-abdominal route plus the application of capsules into the uterine cavity and cervix and the application of needles around the cervix by the vaginal route. The radon seeds are gold of 1.5 mc. each, a minimum of twelve seeds being used by intra-abdominal direct application. The total radiation was from 4,200 to 4,500 mg.-hrs., which probably should be increased. The results so far observed have been very encouraging. There was no mortality from the laparotomy.

W. W. WATKINS, M.D.

The Complications in the Treatment of Carcinoma of the Tongue Following Radium Insertion. A. A. Epstein. *Strahlentherapie*, 1931, XLI, 341-358.

The author analyzes the 90 cases of carcinoma of the tongue seen in his clinic since 1926, from the viewpoint of complications arising during the treatment. He classifies them as follows: Edema of the tongue, hypersecretion of saliva, excessive reactions in the tongue and mucosa of the mouth, hemorrhages, inflammatory reactions and ulceration, necrosis of the tongue and jaw, and retention of foreign bodies in the tongue. As secondary complications he considers disturbances of swallowing and breathing, pain in the tongue and head, limitation in motion of the jaw and tongue. Death may ensue because of acute lung disease, arising as a consequence of the treatment.

The following rules are given in order to avoid complications: It is essential to clean the tongue and the entire mouth carefully. This includes the extraction of diseased teeth. Special protective moulds are necessary if protracted treatment is given. It is not wise to exceed 1.2 to 1.5 M.C.D. per sq. cm. of tumor surface or 1 M.C.D. for large tumors when using needles filtered through 0.5 to 1 mm. Pt. For prolonged treatments 1 mm. Pt filtration is preferable. In order to avoid hemorrhages one should not insert too many

or too long needles and if considerable bleeding occurs it is advisable to ligate the carotid or the lingual artery. The insertion of needles as sole treatment method in cancer of the tongue is suitable only for small or medium sized tumors. Large tumors should be treated by radium and coagulation; otherwise too much radiant energy is absorbed. If the patient is cachectic it is better not to attempt radium therapy.

ERNST A. POHLE, M.D., Ph.D.

Cancer of the Skin. E. H. Molesworth. Jour. Cancer Research Committee of University of Sydney, August, 1931, III, 67-76.

This is an important paper giving the views of one who has had the widest Australian experience of skin cancer, the incidence of which in Australia exceeds that of cancer in any other part of the body. Successful treatment by radiation is possible without the exact planning essential in treatment of deep cancers, but the adoption of similar exact methods has greatly improved results.

There is no line of demarcation between basal-cell and squamous epithelium. It is rare to find a well grown rodent in which some sections do not show whorling, occasional keratinization, or even cell-nest formation. A growth which in actual section and in its clinical aspects appears to be basal celled may, therefore, involve glands, and we should be surprised that this event occurs so rarely.

The more keratinization, the more differentiated—the less keratinization, the more embryonic is the tumor. Embryonic types are more malignant and more radiosensitive. Fortunately the majority of squamous epitheliomas of the skin are highly keratinized, and, therefore, of low-grade malignancy, tending to involve glands at a much later date than the less keratinized epitheliomas common in the tongue. The loss of radiosensitivity is compensated for by the increased dose attainable, owing to the situation in the skin surface.

Keratotic lesions with an infiltrated base are always already developed epitheliomas. The insignificant, uninflamed, pearly tumor is a

later stage, whilst most of the text-book descriptions of basal-cell and squamous epitheliomas apply to still further advanced stages of the disease.

Skin melanomas are resistant to radiation in spite of the embryonic type of their cells. With this exception, skin cancers are amenable to radiation, but high dosage is necessary. A basal-cell epithelioma is never cured by a dose which can be tolerated without permanent damage to healthy skin. At least 50 per cent more than this is required and to be safe a double dose has to be given. An even larger dose may be given to ulcerated lesions. It is the area of skin involved which limits dosage.

Miescher's results that X-radiation will cure 95 per cent of basal-celled epithelioma not involving bone or cartilage are confirmed. In squamous epithelioma not yet involving glands or bone, cures are obtained in 85 to 90 per cent of the cases.

Failures are mostly due to lack of appreciation of minor infiltration which occasionally persists in the cicatrix provided by the first treatment. Only in these cases is a further dose necessary, and it should be applied after the completion of the first radiation effect, *i.e.*, from eight to ten weeks after the first dose. Very few medical men, and certainly not the patient, can be trusted to decide whether a second treatment is necessary after two months.

The degree of reaction required to produce a cure in skin cancer is a deep, dusky edematous one with, in many cases, some crusting. This reaction is habitually aimed at in radium treatment, but for some reason its production is feared by various X-ray workers. The aim should be to win at the first attack because although few, if any, skin epitheliomas are radioresistant in the beginning, they may be educated to resistance by repeated insufficient dosage.

With X-rays the single dose is: 140 K.V., 1 mm. Al filter, 2,000 R (Solomon) or 200 K.V., 0.5 mm. Cu filter, 3,500-4,000 R (Solomon). Such doses must, of course, be delivered only to an area of skin or mucous membrane limited to 4 cm. diameter. For

larger skin areas (which seldom occur) the maximum permissible single dose is 1,000 R (140 K.V., 1 mm. Al) or 3,000 R (200 K.V., 0.5 mm. Cu). To apply greater doses to a lesion involving large areas of skin, cross-fire methods must be employed. With the 140 K.V., 1 mm. Al technic, 1,000 R may be given to the area obviously or probably involved by the growth, and another 1,000 R to the same area plus a margin 1 cm. in diameter outside of it. Ulcerated lesions devoid of epithelium may be given a single dose of 2,500 to 3,000 R (140 K.V., 1 mm. Al). For safety, another dose may be given at the end of two months even when the lesion is apparently cured, as recurrences are mostly due to the survival of insignificant groups of cells in the deeper parts of the tumor.

X-rays have the advantage over radium of giving a better depth dose and are equally effective even on early epithelioma of the lip if the same degree of crusting reaction is obtained.

J. G. STEPHENS, M.D.

The Question of Histologic Changes in Cancer Tissue Following Radiation Therapy. G. Gambarow. *Strahlentherapie*, 1931, XLI, 531-542.

The author discusses the histologic changes in cancer tissue following irradiation. They have been described before and consist chiefly of degeneration of the tumor cells and a secondary proliferation of connective tissue. A number of photomicrograms are appended.

ERNST A. POHLE, M.D., Ph.D.

CHEST (GENERAL)

Contribution to the Knowledge of Triangular, Basal, Paramediastinal Shadows. Gösta Gräberger. *Acta Radiologica*, 1931, Vol. XII, No. 67, 15, VII, 240-253.

The author first reviews the anatomic literature describing accessory lobes of the lung which may be either completely separated from the remainder of the lower lobe or

merely indicated by a groove which demarcates them from the adjacent lung. He publishes two photographs of such accessory lobes in autopsy material.

Assmann has described a case which was considered a mediastinal pleurisy but was proved at postmortem to be a densely infiltrated accessory lobe. Ettig also has described a case of chronic pneumonia in an accessory lobe on the left. Schönfeld has published a case which he believed to be an atelectasis of an accessory lobe but which was not proved by autopsy.

The author describes two cases in his own observation which presented basal, triangular shadows at the first X-ray examination, but on subsequent studies showed clearing of this area, with a sharp line resembling an interlobe remaining as the lateral border of the formerly diseased region. He also describes three other cases presenting sharp lines in the inner portion of the right base which ran obliquely upward toward the hilum and exactly resembled the interlobar lines commonly seen between the upper and middle lobes.

The author believes that the tent-shaped diaphragmatic adhesions seen in the medial portion of the base are due to organized exudate in the grooves separating an accessory lobe from the remainder of the lower lobe.

In order to be visible on the left through the heart shadow, an accessory lobe must be infiltrated or atelectatic. The author shows roentgenograms of two such cases, with infiltration of an inferior accessory lobe on the left.

Accessory lobes must be differentiated from encapsulated, basal, paramediastinal exudate. The lateral border of such an exudate is almost always convex laterally, while the lateral border of an accessory lobe is straight. Induration following a pleural exudate may produce a somewhat similar triangular, basal shadow, but its lateral border is usually concave. Atelectasis of the whole lower lobe on the left or of the right middle lobe also produces a triangular basal shadow with a straight lateral border, but in these cases, other roentgen signs will suggest atelectasis, *e.g.*, compensatory emphysema in the adjacent lung,

retraction of the mediastinum, elevation of the medial part of the diaphragm, etc. The author shows roentgenograms of two such cases of atelectasis, one of the left lower lobe and one of the right middle lobe.

A. L. HART, M.D.

Considerations on the Inception of Axillary Pleurisy in Infancy. Zoila Pinto Interian, Raul Pereira Valdes, and Julio Martinez y Paez. *Revista de Medicina y Cirugia*, July 31, 1931, XXXVI, 515-521.

The authors disagree with Weil and Loiseleur that this condition is usually tuberculous. They believe that a great percentage of it is due to the presence of pneumococcus. Moreover, they think that clinical diagnosis is almost impossible and that the X-ray is the only diagnostic procedure of any value. The prognosis is poor, particularly in nursing babies or when due to the tubercle bacillus. The treatment is usually surgical. They conclude the article by reporting a case treated by them.

N. G. GONZALEZ, M.D.

Cinematization of Pulmonary Lobes and Selective Pneumothorax. Alfredo Vitón. *La Prensa Méd. Argentina*, June 10, 1931, XVIII, 35-41.

In this article, the author pays particular attention to selective pneumothorax, by which we mean partial collapse of the lung, affecting mainly diseased lung. His aim is to prove that such a term sounds good but is entirely erroneous. In his clinics they have had 15,000 superficial pneumothoraces, and he presents several radiographs to prove his point. Most pathologists and physiologists claim that pulmonary parenchyma, when affected by a tuberculous process, collapses more readily than normal lung parenchyma, but according to the author, this does not actually take place, because tuberculous lung tissue has lost some of its elasticity, thus making it harder to collapse.

Autopsies usually do not confirm what was found radiologically and clinically. The author admits, however, that selective pneumothorax

exists, but that it is dependent on the following: The constitutional type of the subject; the size of the corresponding hemithorax; the coefficient of gaseous reabsorption of the pleura; the type of process; the presence or absence of adhesions, and the presence of infiltrative lesions.

N. G. GONZALEZ, M.D.

The Roentgenologic Study of the Diaphragm. Samuel Brown. *Jour. Am. Med. Assn.*, Sept. 5, 1931, XCVII, 678-681.

The roentgenologic study of the diaphragm appears to have been confined chiefly to the antero-posterior view of the thorax. To make the whole of the diaphragm accessible to exploration, a lateral view of the thorax should supplement the usual antero-posterior view. The roentgen anatomy of the diaphragm is detailed, with its relation to physiology.

Anomalous conditions are infrequent. They include absence of the left leaf, eventration (usually on the left side), and alterations associated with transposition of the viscera. The most frequent type of diaphragmatic hernia is the one passing through the esophageal opening. The contours and shape of the diaphragm may be distorted as a result of pleuritic adhesions. Pleuritic effusions or pulmonary tumors may entirely obscure the diaphragm. The lateral view may reveal a pleuritic infiltration not visible in the antero-posterior view. Changes in the position of the diaphragm quite often offer difficulties in correct interpretation. Changes in the mobility of the diaphragm are best studied fluoroscopically.

C. G. SUTHERLAND, M.D.

CONTRAST MEDIA

Diagnosis of Spleen Tumor by Means of a New Contrast Medium Discovered by Radt. E.-E. Bauke. *Deutsche med. Wchnschr.*, July 3, 1931, LVII, 1148, 1149.

The author reports a case of spleen tumor which was visualized following the injection

of thoriumdioxyd-sol (Radt). Ten c.c. were injected intravenously on the first and second days without reaction. After the injection on the third day, a rise in the temperature to 38° C. was noted. On the fifth and sixth days, 20 c.c. were injected. The postero-anterior view of the body showed the liver and spleen to be so well outlined that an exact topographic diagnosis of the tumor within the spleen could be made. Roentgenograms taken before and after the injections demonstrated these findings.

The author believes that this new method offers many advantages over pneumoperitoneum in the differential diagnosis of spleen and liver tumors.

ERNST A. POHLE, M.D., Ph.D.

Myelography with Skiodan (Abrodil). S. Arnell and F. Lidström. *Acta Radiol.*, 1931, XII, No. 67, pp. 287, 288.

The meningeal irritation produced by iodized oil, together with its slow resorption and sluggish movement, limits its general use as a contrast medium in myelography.

Investigation of the possibilities of skiodan (abrodil) as a contrast medium for this purpose has shown it to be non-toxic in concentrations sufficient to produce contrast of diagnostic quality in animals. Injections into the spinal canal of cadavers produce a distinctly visible shadow with a 20 per cent solution. This concentration failed to produce any toxic effects in a patient suffering from tuberculous meningitis when 14 c.c. were injected into the spinal canal. It was almost completely resorbed in thirty minutes.

The possibility of visualization of the sub-arachnoid space and ventricular system is mentioned.

MILTON J. GEYMAN, M.D.

Hepatosplenography with Thorotrast. M. Wellens. *Bruxelles-Méd.*, July 26, 1931, XI, 1159, 1160.

Thorotrast, a stable colloidal suspension of bioxide of thorium (Heyden), has the prop-

erty of fixing itself in the reticulo-endothelial system, particularly the liver and spleen, and thereby allowing a clear visualization of these organs. It is of very low toxicity and the action is persistent for months. Leukocytosis and polynucleosis are often noted.

X-ray films are made twenty-four hours after injection. For the spleen one-fourth c.c. per kilogram of body weight is used, and for the liver, 4 c.c. per kilogram. These doses are at times distributed in several injections. The shadows of the liver and spleen are not always equal, and Wellens suggests that functional values may be worked out of this. He has, thus far, experimented exclusively on animals.

JOHN J. ARCHINARD, M.D.

CYST (HYDATID)

Two Cases of Hydatid Cyst of the Kidney, Excision-Recovery. J. S. Woodman. *British Jour. Urol.*, September, 1931, III, 299.

The author reports two cases of hydatid cyst of the kidney in which excision of the cyst was followed by complete recovery. Pyelograms taken before operation accompany the article. Résumés of the cases are included in the paper.

DAVIS H. PARDOLL, M.D.

DOSAGE

Accuracy in Roentgen Dosage: Chairman's Address. Arthur W. Erskine. *Jour. Am. Med. Assn.*, Sept. 5, 1931, XCVII, 677, 678.

Accurate determination of the dose enables the roentgen therapist to avoid the dangers of over-exposure and under-exposure, both equally a menace to the welfare of the patient.

Errors of approximately 100 per cent are to be expected when the size of the skin dose is estimated from indirect measurements. This error can be brought down to about 25 per cent by checking at regular intervals by a

physicist equipped with an accurate measuring instrument calibrated in absolute units. Within the next year such service will be available throughout the country at a reasonable cost.

The advantages and disadvantages of the measuring instruments in general use in this country are discussed in detail. The routine use of measuring instruments calibrated in absolute units is not such an expensive procedure as to be prohibitive and not so difficult that it is beyond the skill of the average roentgenologist.

C. G. SUTHERLAND, M.D.

Measurement of X-ray Dosage. T. H. Laby. *Jour. Cancer Research Committee of University of Sydney*, August, 1931, III, 83-85.

The paper is an elementary discussion of theoretical X-ray dosage measurement. Since the X-ray tube is a thermionic tube, the author believes that varying amounts of residual gas affect the X-ray emission. The wave form of the voltage applied to the tube varies with different types of mechanical rectifiers and this, too, affects the output, hence the necessity of employing dosimeters such as those based on ionization measurements.

J. G. STEPHENS, M.D.

ESOPHAGUS (THERAPY)

Directions for the Treatment of Carcinoma of the Esophagus. Adolf Zuppinger. *Strahlentherapie*, 1931, XLI, 543-558.

The author presents in this paper a summary of the observations made at the Radiological Institute of the University of Zürich in the treatment of esophageal carcinoma. He states that the roentgen diagnosis of carcinoma of the esophagus should be verified by an examination through the esophagoscope. This also permits a definite localization of the tumor as well as a biopsy. Biopsy is contraindicated if the esophageal mucous membrane is completely intact, in other words, if the patient has a submucous tumor. The his-

tologic character of the tumor should guide us in the choice of treatment and in determining the dose. He feels that both roentgen examination and exploration through the esophagoscope are necessary as complementary methods. Gastrostomy before radiation therapy is started is indicated if the stenosis has reached such a stage that only liquids can pass. Palliative results are obtained with the protracted fractional radium application as well as the fractional roentgen therapy.

For tumors in the cervical part of the esophagus, protracted fractional roentgen therapy is the method of choice. Protracted fractional radium treatment can be applied only if the tumor is small, strictly localized, and within the thorax or abdomen. In all other cases protracted fractional roentgen therapy followed by endo-esophageal protracted fractional radium treatment after an interval of one or two months appears to be preferable. It is necessary to give such high doses that a radio-epithelitis fibrinosa develops. This should be observed through the esophagoscope. Roentgen therapy should be continued until the skin shows a radio-epidermitis sicca.

The technic for the roentgen treatment was as follows: From 2 to 4 skin areas were exposed; two fields with a surface dose of 200 to 300 r are given daily (170 to 180 K.V. eff. half value layer, more than 1 mm. of Cu, 70 cm. F.S.D.). Each area receives from 1,800 to 3,000 r as a total dose. This usually takes about 4 weeks. After from 4 to 6 weeks radium is applied over a period of from 10 to 14 days. The radium screens (13.3 mg. radium element, 1.8 to 2 cm. long, 0.5 mm. Pt iridium filter) are placed in an insulating tube, which, in turn, is placed in a stomach tube and then inserted into the esophagus. At intervals of one or two days the radium is applied for from 2 to 6 hours. The dose per centimeter reaches 1 M.C.D.; if this is increased beyond 1.5 M.C.D., there is grave danger of ulceration. Contra-indications are advanced cachexia or invasion of the trachea or bronchi, extensive metastases, as well as involvement of the lung parenchyma.

ERNST A. POHLE, M.D., Ph.D.

The Radium-roentgen Therapy of Carcinoma of the Esophagus. J. Palugyay. Strahlentherapie, 1931, XLI, 746-749.

The author emphasizes the importance of early diagnosis in esophageal carcinoma. Of 56 cases seen by him during the last three years, 44 had had examination elsewhere. Fourteen of these were far advanced cases and had been pronounced negative four to six months previously or had received a diagnosis of spasm. In 23 cases, which had been examined by another roentgenologist from a few days to three weeks before the author's examination, the diagnosis was either negative or spasm, and, in one case, diverticulum.

Only seven times was the diagnosis correct.

As to the treatment, the author believes that a gastrostomy has to be performed before radiation therapy is begun. The combination of roentgen rays and radium, the latter being applied intra-esophageally, is the method of choice. In the last 10 years, 32 cases were treated. Seven of these are still under treatment, 23 are dead. Nine of these latter died in the third, 5 in the second, and 8 in the first year following treatment. In 21 patients, temporary or partial destruction of the tumor was seen. In two patients, dying one and one and one-half years, respectively, after treatment, no local or metastatic carcinoma was found on autopsy. Two are now alive and well. One patient is a woman, 59 years of age, whose treatment started four years ago and whose gastrostomy was closed about six months ago. The other patient is a woman, 56 years of age, who is alive eight years after the treatment. She has not been treated for the past three years. The first of these cases was proved by biopsy.

These results certainly should encourage us to further efforts in treatment of carcinoma of the esophagus.

ERNST A. POHLE, M.D., Ph.D.

EXPERIMENTAL STUDIES

Serologic Investigations in Cancerous and Precancerous Conditions. Y. Pourbaix. Le Cancer, 1930, VII, 1-40.

This is a long and detailed account of a se-

ries of experiments carried out upon rabbits. The rabbits were divided into five groups, two groups containing animals injected respectively with small and large doses of a radio-active substance (ionium) once weekly. In a third group were animals whose ears were painted with tar once weekly. In the fourth group the tar applications were combined with small doses of ionium, and in the fifth group were the controls. The constituents of the serum studied were the sugar and cholesterol.

It was found that while more or less marked changes were induced in both these constituents by the ionium injections, no marked changes were observed after the tar applications unless a tumor developed. In the animals in which tar-cancer was produced, however, some alteration was observed in the carbohydrate metabolism, as indicated by changes in the blood-sugar level. Even more marked, were the changes in the blood cholesterol. As the author himself remarks, it is not at present possible to say whether or not the changes are characteristic of cancer or precancerous conditions, or are due to concomitant factors.

WALTER M. LEVITT, M.R.C.P., D.M.R.E.

The Effect of the Gamma Rays and X-rays on Blair Bell's Colloidal Lead. W. J. Penfold and James Sutherland. Med. Jour. Australia, July 25, 1931, II, 98-100.

Colloidal lead and silver are phototropic and move towards a source of light, ultraviolet light being more effective than light at the middle and red end of the visible spectrum.

It was hoped that it might be possible to attract colloidal lead to a malignant tumor by means of X- and γ -rays and thus avoid plumbism and augment curative effects.

With 20 mg. of radium in contact with the solution for 24 hours, or X-rays at 100 K.V. and 4 ma., 2 mg. Al filter; target-preparation distance, 12 to 20 inches, for from 10 to 20 minutes, no phototropic effect could be observed *in vitro*.

J. G. STEPHENS, M.D.

Investigations Concerning the Bactericidal Effect of Tissue of Normal and Irradiated Animals. G. M. Antonioli. *Strahlentherapie*, 1931, XLI, 496-509.

The author studied the effect of tissue and organ extracts of normal and of irradiated animals upon staphylococci. He found that small, not too often repeated doses of roentgen rays applied to guinea pigs increased the bactericidal effect of the tissue and the organs. The spleen and liver take first place in the bactericidal action. The difference between non-irradiated and irradiated liver and spleen was considerable. Much less is the difference for kidney and omentum, comparing the non-irradiated and irradiated organs. There was hardly any difference for the lungs and skeletal muscles. A definite decrease of the bactericidal effect was seen in the skin of the back which served as a port of entry. Following an intensive roentgen exposure of guinea pigs, brought about by high and frequently repeated doses, a marked decrease of bactericidal effect of the tissues and organs was seen as compared with the untreated controls. The liver, spleen, and kidney as well as the irradiated skin showed the most marked drop in the bactericidal power. The drop was less for the omentum. There was hardly any difference for the lungs and skeletal muscles. It is very difficult to explain these observed phenomena. The reticulo-endothelial system may play a rôle; it is possible that small doses of roentgen rays increase its activity while high doses inhibit it.

ERNST A. POHLE, M.D., Ph.D.

Short Wave Irradiation of Rat Sarcoma. Erich Pflomm. *Münch. med. Wchnschr.*, Oct. 24, 1930, LXXVII, 1854-1856.

E. Schliephake, in 1929 (*Zeitschrift für Experimentelle Medizin*, LXVI, Issues 1 and 2), published in detail the technic of irradiation with hertzian waves.

The author used waves of 3.20 meters for the irradiation of Jensen rat sarcomas and produced marked degeneration and necrosis without curing any of the experimental ani-

mals. From his discussion it is apparent that the result is partly the effect of heat. However, an additional direct influence of irradiation must be assumed, which, apparently, depends partly upon the wave length used and especially upon the specific reaction between irradiated tissue and certain wave lengths. It was noticed, for instance, that different types of tissue showed a different increase in temperature, that relatively limited variation in wave length produced quite different effects and marked variation in temperature. Also reactions on chemicals are quite different from those produced by temperature alone; oil of turpentine, for instance, becomes resinous. Polymerization by an exposure of a few minutes to short waves while heating over a gas flame to the same temperature produced by the irradiation requires eight hours for the same result.

The studies reported may eventually lead to important additional information concerning the selective and specific effects of spectral irradiation upon various biologic units.

HANS A. JARRE, M.D.

Clinical and Experimental Studies Concerning the Light Sensitization by Trypaflavin. H. Videbech. *Strahlentherapie*, 1931, XLI, 417-434.

The author starts with brief historical sketch of the development of light sensitization in therapy. He describes four cases of lupus vulgaris in the mouth and in the pharynx treated by carbon arc light following sensitization with trypaflavin. The efficacy of the sensitization was doubtful. He also undertook experiments on white rabbits. Certain skin areas and the ears of these animals were exposed to carbon arc light following intravenous injection of trypaflavin. Macroscopically, there was a definite sensitization which was particularly marked following exposure to the visible light spectrum. Microscopic examination of the exposed areas showed that following sensitization by trypaflavin there was a more marked reaction in the connective tissue as compared with the non-sensitized

animals. Whether or not this effect is desirable in clinical therapy appears to be doubtful.

ERNST A. POHLE, M.D., Ph.D.

Bactericidal Action of Irradiated and Non-irradiated Methylene Blue on the Meningococcus. R. Dujarric de la Rivière, Et. Roux, and Françoise Cavallier. *Compt. rend. Soc. de biol.*, March 20, 1931, CVI, 799-802.

Previous experiments were made which demonstrated that the bactericidal power of methylene blue on the meningococcus is above 1 per 50,000 and below 1 per 400,000. Observations were made on a scale of dilutions intermediate between these two figures.

In the technic employed, 1 c.c. of each dilution was mixed with an emulsion of meningococcus and incubated for 24, 48, and 72 hours. Control cultures of meningococcus were also incubated in order to ascertain their vitality. The experiments were carried out for each sample of methylene blue with or without irradiation (irradiation for 20 minutes). In all samples irradiated and not irradiated, the cultures remained sterile for 24 hours, while those not irradiated showed abundant cultures after 48 and 72 hours in dilutions of 1 per 200,000 to 1 per 400,000. The irradiated samples were sterile all the way down to dilutions of 1 per 400,000 with a few colonies in dilutions of 1 per 300,000 and 1 per 400,000.

The main deductions of these experiments are: (1) That bactericidal power of methylene blue to the meningococcus is quite high, always above solutions of 1 per 100,000; (2) that the difference of bactericidal power with and without irradiation is distinct, being less, however, than with trypaflavin. Irradiated blue has held as far as 1 per 400,000, the non-irradiated blue as far as 1 per 200,000 at most (trypaflavin: 1 per 200,000 when irradiated against 1 per 300,000 when not irradiated).

With a view to increasing the power of ultra-violet rays, two experiments were made. In the first set, methylene blue was cholesterinized, and in the second, the blue was not so treated, both sets being irradiated with ultra-

violet rays. The result was a diminution of germicidal action in the blues not cholesterinized and little or no difference in the irradiated and non-irradiated mixtures.

The experimenters observed that certain blues employed contained notable quantities of iron. The addition of iron to blues known to contain but small traces of it demonstrated that the bactericidal power is neither increased nor diminished thereby.

It is thought that ozone liberated in the apparatus during irradiation might increase antiseptic power. Irradiation was prolonged for 40 minutes (double the time of exposure for other irradiations), and no difference was observed in microbicidal power.

Finally, the following experiment was performed: A set of rabbits and guinea pigs was given intraperitoneal injections of meningococcus emulsion followed by a solution of methylene blue. Another set of the same animals received the meningococcus emulsion alone. Fifteen minutes later, specimens of peritoneal fluid of all the animals were cultured. These were positive for the animals injected with meningococcus and negative for those receiving both meningococcus and blue.

The decided antiseptic action of methylene blue, irradiated or not, and its very slight toxicity would seem to encourage its use in meningococcal infections.

HENRY BAYON, M.D.

Experiments on Plants and Animals Placed in the Electric Field of a Short Wave Generator. Kj. von Oettingen. *Strahlentherapie*, 1931, XLI, 251-285.

The author described the results of his experiments dealing with the effect of electric waves of about 3-meter length on inorganic and organic matter. The apparatus used was the same as designed by Esau (Jena). Inorganic substances were partly heated, partly changed chemically. In the tests on plants, a stimulative as well as a destructive dose could be determined. The histologic changes in the tissue of animals consisted chiefly of tissue necrosis in severe cases, of degenerative processes, or true inflammatory reactions, depending on the resistance or the character of the

organs. In some experiments with carcinoma in mice, retardation of growth and regression of the tumor were seen, similar to the observations of Pflomm in rat sarcoma. Other wave lengths may have different effects.

ERNST A. POHLE, M.D., Ph.D.

The Effect of Radium on the Blood Sugar in Various Blood Vessels and Its Distribution between Formed Elements and Plasma. N. P. Kotschneff. *Strahlentherapie*, 1931, **XLI**, 359-369.

If radon is introduced into the intestines or into the stomach while carbohydrates are being digested, there is a marked increase of sugar in the entire blood. Extensive experiments on dogs showed that this is apparently due to a decreased sugar retention of liver and muscles, while the sugar retention of the kidneys is increased. Following the introduction of radon into the stomach, intestines, or blood, the plasma sugar was increased and the sugar in the cells relatively decreased. This holds whether the animal was or was not digesting a meal.

ERNST A. POHLE, M.D., Ph.D.

GALL BLADDER (NORMAL AND PATHOLOGIC)

The Study of Gall-bladder Contractions as an Aid in the Roentgen Diagnosis of Gall-bladder Disease. George Levene. *Am. Jour. Roentgenol. and Rad. Ther.*, July, 1931, **XXVI**, 87-91.

The writer stresses the importance of adequate study of the contraction response of the gall bladder to the fatty meal stimulus as the key to more accurate roentgenologic diagnosis, particularly in that group of pathologic gall bladders (frequently with stone formation) which may show good filling and some degree of emptying response to fat food. The author believes in an active expulsive contraction function as a part of normal gall-bladder physiology. On this basis he applies roent-

genoscopy as an aid to roentgenography in the study of the contraction response during the interval shortly after ingestion of the fatty meal, and by this means has, at times, observed normally active gall-bladder contractions, but relatively slow emptying, which has usually subsequently been shown due to stone obstruction, the stone acting as a ball-valve. The administration of a barium meal during the period of gall-bladder visualization has been used successfully to determine the presence of cholecystic adhesions.

J. E. HABBE, M.D.

Note on a New Orientation in the Pathogenic Therapy of Biliary Calculi. S. Tzovaru. *Arch. d. mal. de l'app. digestif*, June, 1931, **XXI**, 703-709.

This is a preliminary report expressing the author's conception of the cycle involved in the production of biliary stones. The blame is placed on a primary increase in cholesterol of the suprarenal cortex origin. From the fact that the frequency is greater in women and the knowledge that a high blood cholesterol does exist during pregnancy, menstruation, and the menopause, aided by necropsy findings of hypertrophy of the suprarenal cortex in these conditions, the theory is advanced that this hypertrophy is followed by hypersecretion of cholesterol. The cortex is very rich in this substance and a source of a large proportion of its production. Besides this, there must be some alteration of the hepatic cells by toxins, due either to pregnancy or to biliary infection (often by *B. coli*) and stasis.

In typhoid fever, besides the presence of the bacilli in the biliary tract, there is present during convalescence a high cholesterol index in the blood, and necropsy of patients dying during this period has shown a great hypertrophy of the suprarenal cortex.

In rabbits and guinea pigs, cholesterol injections into the gall bladder after a partial obstruction had been created led to the formation of stones, while cholesterol injections without obstructions produced no change.

Removal of the gall bladder, followed by a

course of mineral waters and low cholesterol diet, favored the elimination of cholesterol and improved the local liver condition, thus preventing calculi formation.

The author suggests the use of intense X-radiation of one of the suprarenals to cause atrophy and functional inhibition of the gland. A smaller dose would cause hypertrophy. He also brings out the possibility of surgery for removal of the hypertrophied cortex.

B. J. DE LAUREAL, M.D.

The Diagnosis of Gallstone Disease. H. L. Bockus. *Med. Times and Long Island Med. Jour.*, August, 1931, LIX, 273-276.

The purpose of the author was to evaluate the two methods, cholecystography and non-surgical biliary drainage, in gallstone diagnosis, based on 178 cases operated upon. Where the gall bladders were classed by the surgeon as functioning, bile drainage was found superior to cholecystography in determining the presence of stones. Of the cases found to have stones, 21 per cent had been reported as having normal function without visible evidence of stone.

W. W. WATKINS, M.D.

Cholecystographic Studies by Means of "Decholin-distention" and "Egg-yolk-contraction." Heinz Taterka. *Röntgenpraxis*, Aug. 15, 1931, III, 721-731.

If one injects decholin intravenously (from 8 to 10 c.c. of a 20 per cent solution) after cholecystography, one can demonstrate an increased bile flow on the cholecystogram, the maximum dilatation of the gall bladder being seen about forty-five minutes afterwards. By a combination of this method with the emptying by means of egg yolk, one gets an idea of the kinetic function of the gall bladder, the gall bladder filled *ad maximum* (by decholin), and the emptying gall bladder (egg yolk). By comparison of these films one can differentiate physiologic and pathologic changes in position, shape, and contour of the gall bladder. The permanency of abnormal

findings is pathognomonic in all three phases. An interesting series of film-reproductions illustrates the article, one of which shows the cholecystogram of a carcinomatous filling defect in the gall bladder.

H. W. HEFKE, M.D.

Cholecystographic Investigations of the Gall-bladder Function Following Stomach Operation. Heinz Kalk and Karl Nissen. *Deutsche med. Wchnschr.*, July 17, 1931, LVII, 1232-1234.

Cholecystographic studies of persons who had had an operation on the stomach show that the gall bladder is emptied even though the food does not pass through the duodenum, but directly reaches the jejunum. It is assumed, therefore, that this emptying reflex must be released in the upper part of the jejunum. Two roentgenograms of the gall bladder are appended.

ERNST A. POHLE, M.D., Ph.D.

Gall-bladder Diseases: Diagnosis and Indications for Operation. Roy D. McClure. *Jour. Michigan St. Med. Soc.*, May, 1931, XXX, 356-360.

We can to-day make a much earlier diagnosis of gall-bladder disease than formerly, due to two new methods developed since the great war, one of which is cholecystography.

Many reports have been published on the value of this method. This author, who is a surgeon, finds that the total cholecystographic diagnoses were correct in 88.1 per cent of the cases. In his opinion, the duodenal drainage tube, if properly conducted, is even more accurate in diagnosing cholecystitis.

W. W. WATKINS, M.D.

Critical Remarks Concerning the Roentgen Diagnosis of Gall-bladder Disease. J. Geling. *Deutsche med. Wchnschr.*, May 22, 1931, LVII, 881, 882.

The author discusses critically the pitfalls in the diagnosis of gall-bladder disease by

means of a contrast medium. Several case histories are appended illustrating some of the typical errors. He concludes that the positive gall-bladder shadow does not prove that the gall bladder is normal. There are a number of functional disturbances which may be detected by means of the yolk-of-egg test. The simultaneous roentgen visualization of the gall bladder and stomach represents a definite diagnostic progress. If the gall-bladder shadow is absent, a number of possible sources of error must be ruled out instead of blaming the method itself for mistakes of the examining physician.

ERNST A. POHLE, M.D., Ph.D.

Roentgen Diagnosis of Gall-bladder Disease. George M. Street. *New Orleans Med. and Surg. Jour.*, April, 1931, LXXXIII, 679-682.

The author concludes a general discussion of this procedure with the following points: (1) The intravenous method gives more uniform and reliable cholecystograms and has the advantage of allowing a liver function test to be made at the same time. (2) If the oral method is employed, a solution of dye mixed with grape juice should be used, not capsules. (3) More evidence than a pale filling gall bladder is required for a diagnosis of cholecystitis. (4) Deformities of the outline do not always mean pathology or adhesions. (5) Pancreatitis, with partial obstruction of the common duct, or stone in the duct, may be causes of delayed emptying. (6) We still have much to learn about the interpretation of cholecystograms.

W. W. WATKINS, M.D.

GASTRO-INTESTINAL TRACT (DIAGNOSIS)

The Diagnostic Importance of the Relief Examination of the Mucosa of the Colon.

Géza Györgyi. *Röntgenpraxis*, Sept. 1, 1931, III, 769-776.

By means of a barium enema, the author follows the regular examination of the colon by an examination of the relief. The bowel is emptied as much as possible, and the contrast material is distributed through the colon by means of massage. The study of the mucosa-relief necessitates the study of films, fluoroscopy alone being satisfactory for only the old method.

A group of cases are reported. Normally the relief of the mucosa is different in the ascending and transverse colon from the descending colon and sigmoid, which probably can be explained by different physiologic requirements (absorption). Colitis, diverticulosis, and diverticulitis are much more easily recognizable by this type of examination. It is very important in the diagnosis of tumors of the colon, which might be entirely missed by the old method (small size and unfavorable situation). The extent of a tumor can be seen with much more accuracy, as one is able to differentiate pathologic from normal mucosa in most cases.

H. W. HEFKE, M.D.

The Diagnosis and Treatment of Acute Intestinal Obstruction. Owen H. Wengenstein. *Northwest Med.*, September, 1931, XXX, 389-407.

Among other criteria on which a diagnosis of bowel obstruction may be made early is the roentgenographic evidence. It has long been recognized that X-ray examinations are of value in detecting bowel obstruction, but they have not yet been given the recognition they deserve. The demonstration of free gas in the small bowel is abnormal and indicates intestinal stasis; the "ladder pattern" of Case need not be waited for in order to make a diagnosis. If the gas appears over fluid, it is still more certain. To determine whether the visualized gas is in the small or large bowel is sometimes difficult. The distended small bowel is usually central, the long axis of the shadow is transverse, and the two intestinal walls separating adjacent loops are seen as

thin and narrow lines. Colonic gas is usually along the lateral borders of the abdomen; the long axis of the shadow is usually vertical and haustral markings are often in evidence.

W. W. WATKINS, M.D.

A Contribution to the Roentgen Diagnosis of Acute Pancreatitis. Carl-Heinz Goldmann. Röntgenpraxis, Sept. 1, 1931, III, 793-796.

In cases of acute pancreatitis the pancreatic tumor may fairly often be seen as a dense shadow in the midportions of the upper abdomen. The colon is dilated by gas and the left diaphragm shows a decreased motion. The stomach and duodenum sometimes show changes in contour and situation. A flat film of the abdomen, showing the shadow as described above, seems to be a rather characteristic and easily obtainable diagnostic sign.

H. W. HEFKE, M.D.

**GASTRO-INTESTINAL TRACT
(THERAPY)**

Nitrites in Spasmodic Conditions of Gastro-intestinal Tract. Argyl J. Beams. Jour. Am. Med. Assn., Sept. 26, 1931, XCVII, 907-910.

Drugs that act as antispasmodics on the gastro-intestinal tract occupy an important place both in the diagnosis and in the treatment of certain conditions of the stomach and intestine. Atropine has been generally accepted as a satisfactory antispasmodic, but a review of the literature shows exceptions to this. Studies were made on the effect of nitrites on the mobility of the alimentary tract. In these studies, nitrites have proved a valuable diagnostic measure in differentiating spasm from organic lesions. In fluoroscopic studies the nitrite was somewhat disappointing in its action on cardiospasm and pyloric spasm but proved effective in gastric spasm and spasm of the colon. Another important diagnostic aid is that in producing relaxation of the stomach and intestine, not involved by an organic le-

sion, it accentuates the deformity caused by the lesion. In this manner it may visualize a deformity that has been overlooked. The effect of nitrites in abdominal pain may prove a valuable aid in diagnosis. Muscle-spasm pain was relieved by nitrites, but pain due to inflammatory processes was not relieved. More observations must be made before any definite conclusions can be drawn, but it appears that any pain in the gastro-intestinal tract relieved by nitrites is caused by muscle spasm.

In the treatment of spasmodic conditions of the gastro-intestinal tract, sodium nitrite did not prove satisfactory in the upper alimentary tract, but the results were gratifying in spasm of the colon.

Belladonna was much more effective than sodium nitrite in the treatment of cardiospasm and pyloric spasm.

Nitrites are more effective than atropine as an antispasmodic in roentgen examinations. Nitrites are preferable to atropine, being more easily administered, more prompt in action, and causing less discomfort to the patient.

C. G. SUTHERLAND, M.B.(Tor.)

The Effect of Hypothyroidism on Gastric and Intestinal Function. Thomas R. Brown. Jour. Am. Med. Assn., Aug. 22, 1931, XCVII, 511-513.

This is a very interesting case report of a woman who, because of a chronic and intractable constipation, came to the hospital, in 1915, for resection of the colon. Roentgen examination showed no apparent delay in the barium column reaching the various portions of the colon.

The patient was started on 2 grains (0.13 gm.) of thyroid three times daily. In twenty-four hours she began to have normal bowel movements, and this has continued to the present time.

One hundred and fifty-six cases were studied as a result of the experience of this case. Practically all were chosen from the group of middle-aged women in the later forties or the early fifties, whose main complaint was constipation, other minor symptoms being in-

crease of weight and sometimes slight mental sluggishness.

It is evident that hypothyroidism plays a considerable part in certain cases of intractable constipation not corrected by the usual means.

C. G. SUTHERLAND, M.B. (Tor.)

GENITO-URINARY TRACT (DIAGNOSIS)

Gunshot Wound of Ureter: Case Report.
R. M. Le Comte. *Jour. Urol.*, September, 1931, XXVI, 447.

The author reports a case of gunshot wound of the ureter illustrated by pyelograms of the condition before and after operation. The literature on the subject has been covered rather extensively.

DAVIS H. PARDOLL, M.D.

Malignant Lymphoma and the Urinary Tract. Richard Chute. *Jour. Am. Med. Assn.*, Oct. 3, 1931, XCVII, 969.

Under the term malignant lymphoma or lymphoblastoma are included several types of neoplastic growths of the lymphatic cells of the body, which, however, are related in that they all have the common characteristics of forming lymphatic cell tumors or infiltrations throughout the body and of being absolutely fatal. Among these are: Hodgkin's disease or lymphogranuloma, lympho-epithelioma, lymphosarcoma, and lymphatic leukemia. Some pathologists believe these are but different types of one disease, a malignant lymphatic neoplasm, which on different occasions manifests itself in different ways. In many instances a combination of two or more of these types is found in the same case of lymphoma. It is apt to start with a slow, painless, firm enlargement of the lymph glands of one region, most often in the neck. It may start in some organ, but this is unusual. The process slowly spreads, and the lymph glands of other regions of the body enlarge. As the disease progresses, weakness, anemia,

and cachexia creep over the patient. The average length of life from the onset of the symptoms to the end is between two and a half and three years. During the course of the disease, spontaneous remissions may occur. Patients have been known to live for many years.

Roentgen therapy affords the best treatment known; unfortunately, however, this is only palliative. Nodules in one or both kidneys are very common; one or both ureters may be surrounded by a mass of lymphoma and pressed on, or even actually invaded. The bladder may be pushed up by masses of lymphoma outside it or may itself be involved. The spermatic cord, also one or both testicles, may be infiltrated. The prostate may even be the primary seat of the disease. Involvement of the posterior urethra and penis has been reported. The scrotum and penis may be enormously swollen and edematous because of pressure in the lymphatics.

Points in the diagnosis are taken up and a few cases with autopsies are given as examples.

C. G. SUTHERLAND, M.B. (Tor.)

Intravenous Pyelography. M. Glorieux. *Bruxelles-Méd.*, July 26, 1931, XI, 1159.

The author replies to criticism of the above method by J. François, as follows:

(1) In simple determination of the presence or absence of a kidney, pyelography by intravenous injection of uroselectan is adequate, as it fails to give any shadow in only 2 per cent of cases; whereas pyelography by ureteral catheter is not infrequently impossible.

(2) In the diagnosis of hydronephrosis, injection by catheter is unphysiologic and may not reveal its presence, at times inducing spasm and colic.

The statement that uroselectan may provoke a hydronephrosis is inaccurate. Such cases are actually intermittent hydronephroses which were not shown by injection by catheter.

(3) In renal tuberculosis the intravenous route admittedly is unsatisfactory, yet cystos-

copy and catheterization are at times unjustifiable.

(4) In renal calculus, pyelography is often superfluous, the density of solutions injected by catheter at times hiding the stone.

(5) Not all tumors are visible; sometimes they are clearly seen, other cases requiring pyelography by cystoscopy.

(6) As regards effect on renal function, the intravenous method is as safe as the other.

Discussion.—Boine estimates that not theory, but actual observation and check-up of accuracy by operations and autopsies must evaluate the two methods. De Backer states that there is no danger whatever attached to intravenous pyelography and adds that this method should be tried first, and, if unsatisfactory, cystoscopy should be resorted to.

JOHN J. ARCHINARD, M.D.

Intravenous Urography by Means of Uroselectan. O. A. Nelson. *Northwest Med.*, January, 1931, XXX, 34, 35.

Kidney function should be known before using this method. When the renal function is good and urine normal, the intravenous method of pyelography is very valuable, tumors in the kidney are readily diagnosed, and we can easily discover ureteral lesions, such as obstruction, renal displacement, and renal anomalies. We cannot depend on this method alone. It should not be used when patients are acutely ill, in cases in which there is a low renal function, nor when renal tuberculosis or early tumor are suspected.

W. W. WATKINS, M.D.

Diseases of the Urinary Tract in Infancy and Childhood. Herman L. Kretschmer. *Surg., Gynec. and Obst.*, August, 1931, LIII, 129-154.

The author states that the literature on modern urology in infancy and childhood has increased to an enormous extent. He emphasizes the fact that in taking the history the keen observation of the mother is often a de-

ciding factor in establishing the diagnosis. Under the heading "Examination" the following order is observed:

(1) Physical examination; (2) examination of the urine; (3) roentgen-ray examination. Under this head he includes the presence of stone, presence of areas of calcification in cases of renal tuberculosis, and bony defects of the spine and pelvis; (4) estimation of residual urine; (5) determination of renal function; (6) intravenous pyelography, uroselectan being the drug used; (7) cystoscopy and ureteral catheterization. He states that pyelography may be deferred for subsequent examination.

Malignant tumors of the kidney are divided into three groups:

- (1) Those having origin in renal capsule (these are rare);
- (2) Those of the kidney pelvis (these are rare);
- (3) Those of the renal parenchyma (the most common type).

Trauma plays a negligible rôle in production of these tumors. The one constant symptom is enlargement of the abdomen, but among the general symptoms are fever, abdominal pain, loss of appetite and weight, also irritability. They are more frequent in males, in the author's series 14 to 3. Hematuria is uncommon in the child. A plain roentgenogram is made for the outline of the tumor, and intravenous pyelography is used. Metastases occur in the liver, the lung, and occasionally through the entire abdomen.

Chronic renal tuberculosis is rare in childhood but should always be kept in mind. The problem is the same in children as in adults. Uroselectan is advocated as an adjunct to diagnosis.

Stones in the urinary tract are relatively rare. They are most frequently found in the bladder of children averaging 7.8 years of age. The diagnosis is similar to that in adults, but in every case of enuresis X-ray study of the genito-urinary tract should be made.

The acute and chronic infections of the kidney are discussed, as are the congenital anomalies of the urinary tract. Spina bifida may have urinary symptoms. The spinal cord

bladder is not common in childhood but should be borne in mind. The varied headings discussed are explained by illustrated cases.

DONALD S. CHILDS, M.D.

Endometriosis. Frank E. Kliman. *Minn. Med.*, June, 1931, XIV, 504-506.

Endometrial-like tissue may occur in such places as the ovary, rectovaginal septum, uterus, and sometimes in extragenital locations. It is governed by the ovarian hormone and passes through characteristic cyclic changes during menstruation. This paper is concerned only with endometriomas of the rectovaginal septum which may occur: (a) As discrete nodules in the vaginal wall (rare); (b) small tumors in the upper part of the septum, but not involving the rectum; (c) those involving the supravaginal portion of the cervix and the rectal wall, and (d) those originating in the septum, but spreading to neighboring tissues. Radium and the X-ray or a combination of both is the treatment of choice and is directed to the local lesion and to the ovaries for ablation of their functional activity.

W. W. WATKINS, M.D.

Tabloid Summary of Hematuria Causation. Charles H. Chetwood and Alfred G. Flagg. *Urol. and Cutan. Rev.*, August, 1931, XXXV, 483-486.

The authors report a series of cases in which hematuria was the outstanding symptom. They summarize the causes of hematuria as follows:

I. Conditions in the urinary tract:

(A) Renal causes—

1. Malignant tumors
2. Papilloma of the renal pelvis
3. Injuries to the kidney
4. Renal calculi
5. Renal tuberculosis
6. Hydronephrosis
7. Renal mobility
8. Acute nephritis

(B) Bladder causes—

1. Papilloma or carcinoma

2. Enlarged prostate
3. Diverticulum of the bladder
4. Bladder calculi
5. Injuries to the bladder, such as in fractures of the pelvis
6. Tuberculosis of the bladder

(C) Ureteral causes—

Ureteral stone

(D) Urethral causes—

1. Acute congestion of urethral mucous membrane
2. Impaction of a stone in the urethra
3. Urethral injury

II. Causes of hematuria due to disease in adjacent organs:

- (A) Carcinoma of pelvic organs
- (B) Appendicitis by spread of inflammatory process to bladder
- (C) Acute salpingitis or pelvic abscess
- (D) Tuberculous or dysenteric ulceration of the intestines
- (E) Inguinal hernia involving a portion of the bladder in the hernial sac

III. Hematuria in general diseases:

- (A) Sudden plugging of renal vessel by embolism, as in endocarditis
- (B) Leukemia
- (C) Scurvy or purpura
- (D) Acute nephritis
- (E) So-called idiopathic hematuria

In the authors' series of cases, history, physical examination, cystoscopic examination, intravenous uroselectan, and retrograde pyelography were employed in reaching a final diagnosis. Reproductions of roentgenograms are included.

J. N. ANÉ, M.D.

**GENITO-URINARY TRACT
(THERAPY)**

Uretero-heminephrectomy in Infancy. Meredith F. Campbell. *Jour. Urol.*, September, 1931, XXVI, 433.

Two cases are reported of female infants (six and twenty-eight months old) in whom

uretero-heminephrectomy was successfully carried out for uretero-hemipyonephrosis. An ectopic ureteral opening was present in one and at first served to increase the diagnostic difficulties. Ectopic ureteral openings, because of urinary leakage, usually cause the child to be classed as an enuretic. The patient is the seventh of this type reported in whom ureteral ectopy did not result in urinary incontinence. In one of the cases, hydroureter and hydropyonephrosis existed above the site of a congenital ureterovesical junction stricture.

The treatment of hemipyonephrosis is surgical. Even infants withstand radical urinary tract surgery surprisingly well if strict attention is paid to pre-operative and post-operative care, bearing in mind that severe acidosis is likely to develop during the first forty-eight hours following operation.

X-ray films accompany the article illustrating the pathology and operative procedure.

DAVIS H. PARDOLL, M.D.

Prostatitis and Its Treatment. Monroe E. Greenberger. *Urol. and Cutan. Rev.*, August, 1931, XXXV, 487-489.

Twenty-five per cent of cases of prostatitis are the result of the spread of infection from distant foci of infection by lymph and blood streams and, therefore, are not venereal in origin. In the acute case, the onset is usually sudden without a recent history of urethral discharge. Chronic prostatitis is always a prostatovesiculitis. While the symptomatology varies, the following complaints are most common: a slight muco-purulent urethral discharge; pain or burning on urination; dull perineal pain, referred to the inguinal region, and backache.

The diagnosis can be made only by rectal examination. In the acute cases, the prostate feels hard and tense and is exquisitely tender. The severity of the chronic type may be determined by microscopic examination of the expressed fluid.

After the eradication of the foci of infection, diathermy is believed to be the most satisfactory agent in the treatment of prostatovesiculitis. It may be employed in the acute

as well as in the chronic cases, for it relieves pain, decreases the prostatic mass, and aids in complete resolution. With the patient in the dorsal position, the active electrode is lubricated with petrolatum and slowly inserted in the rectum, so that the exposed surface is held in direct contact with the prostate. The inactive electrode is coated with soap and water and placed over the suprapubic region. The current is advanced slowly so that there is at no time a painful sensation. From 500 to 1,500 milliamperes, for a duration of at least 30 minutes, are administered to the patient once or twice daily, this treatment being continued until all symptoms disappear and until not more than from six to eight pus cells are present to a high power field. At the termination of the treatment, the anterior urethra is lavaged with 1-4,000 acriflavine in normal saline. The prostate and seminal vesicles are not massaged in the acute stage. Suppositories of extract of opium and extract of belladonna aid in making the patient comfortable.

In chronic prostatovesiculitis, diathermy is employed at from four- to five-day intervals, followed by massage on a full bladder. Urethral or bladder lavage is then employed, using 1-4,000 acriflavine in normal saline. Vaccines and foreign protein therapy have been of no material aid in the treatment of these cases.

J. N. ANÉ, M.D.

The Value of Modern Urological Therapy in Obviating or Decreasing Major Surgery of the Bladder and Prostate. John R. Caulk. *Urol. and Cutan. Rev.*, August, 1931, XXXV, 489-495.

The author believes that the contribution of conservatism to modern urology has made possible the relief and in a large measure the cure of about 90 per cent of the common pathologic lesions of the lower urinary tract in a manner far superior to that previously afforded by radicalism in the guise of open surgery. In his own series, endovesical therapy has supplanted open operation in 80 per cent of cases during the last ten years. Transurethral surgery has resulted in a

marked improvement in results without the attendant dangers of open operation.

The correction of local conditions in the bladder responsible for inflammation is becoming more and more delegated to cystoscopic treatment. Stone, tumor, and obstruction may be treated exclusively by transurethral surgery. In the author's opinion, this operation is also applicable to vesical calculi complicated by other conditions. The coincidence of carcinoma and stone in the bladder has been more satisfactorily dealt with by keeping the bladder closed, if the crushing is performed in the cavity and not against the bladder wall. In carcinoma of the prostate associated with vesical stones, litholapaxy, the perineal implantation of radium to the prostate, deep X-ray therapy, and the mechanical relief of obstruction have given results decidedly superior to open surgery. Following litholapaxy, the author employs repeated instillations of bulgura cultures into the bladder and has found this procedure of value in solving the problem of stone recurrence. There is no necessity for general anesthesia in cystoscopic surgery, because local or caudal, and occasionally low spinal, anesthesia will answer all the requirements.

In carcinoma of the bladder, because of the economic loss, mortality rate, complications, hospitalization, and physical suffering following open surgery, transurethral surgery with repeated radium implantation, in association with electrocauterization and deep X-ray therapy have been found superior. The longer villous tumors are most susceptible but practically all such projectile tumors, whether solid or villous, in a large percentage of cases lend themselves admirably to endovesical therapy.

The benign tumors of the bladder, chiefly epithelial in origin and papillomatous in character, are equally susceptible to endovesical therapy. Open surgery is definitely contraindicated for these apparently benign tumors, the use of the high frequency spark having since 1910 entirely supplanted open surgery. Angiomas, the source of profound hematuria and uterovesical cysts, likewise are effectively treated by the high frequency spark.

In recent years there has been a correspond-

ing trend towards conservatism in the treatment of obstructive lesions involving the bladder. The author employs the cautery punch operation in about 85 per cent of all types of obstructions occurring at the internal orifice of the bladder. Complications are exceedingly few. Epididymitis is most frequent but this occurs no more commonly than following catheter drainage or other instrumentation.

Conservative therapy has been found of tremendous value in the treatment of carcinoma of the prostate. Suprapubic enucleation almost invariably kindles the flame of carcinomatous spread and hastens the end except in a few cases of encapsulated carcinomatous areas within pre-existing hypertrophy. For this reason most surgeons have discarded the enucleation operations and have substituted X-ray therapy, radium emanation, and minor procedures for the relief of obstruction. In some cases, deep X-ray therapy and radium implantation will relieve the symptoms of obstruction. In other cases the cautery punch operation will be found of value to relieve the mechanical interference with urination.

J. N. ANÉ, M.D.

GRENZ RAYS

The Effect of Grenz Rays on Cholesterol and its Fatty Acid Esters in Vitro. Rudolf Hummel. *Strahlentherapie*, June 13, 1931, **XLI**, 142-144.

Roffo and others have shown that cholesterol dissolved in chloroform is destroyed by roentgen rays. Grenz rays in doses up to 10,000 r have not that effect. If cholesterol is dissolved in blood serum, it is also not altered by exposure to Grenz rays *in vitro*.

ERNST A. POHLE, M.D., Ph.D.

Grenz-ray Therapy in Dermatology. J. Samek. *Strahlentherapie*, 1931, **XLI**, 762-766.

The author has treated 200 dermatologic cases during the past year by Grenz rays (11 K.V., 10 ma., 10 cm. F.S.D., H.V.L. in Al, 0.028 millimeters). Skin erythema was usually seen beginning with 300 r. Samek feels that there are certain skin diseases in

which Grenz rays are strongly indicated, for instance, morbus Darier. Since there is also little danger of cumulation, Grenz rays should be of advantage in chronic eczemas, in psoriasis, and in severe cases of acne. The single dose in these diseases varies between 100 and 200 r, usually repeated at weekly intervals three or four times. Neurodermatitis has also responded well. Alopecia areata did not respond to doses of from 300 to 400 r. The results were good in erythema induratum Bazin (300 r) and in tuberculosis verrucosa cutis. Other types of lupus, particularly scrofuloderm, did not respond at all. Warts respond only to doses of about 1,000 r, and the erythema and following pigmentation are not always desirable from a cosmetic standpoint. Nevus flammeus and rodent ulcer were treated with 2,000 r with excellent cosmetic results. No statement as to the efficacy of general body exposure with Grenz rays can be made by the author, because in a small number of cases no definite results were seen. In conclusion, Samek states that Grenz-ray therapy is indispensable as a dermatologic treatment method.

ERNST A. POHLE, M.D., Ph.D.

Use of Bucky Rays in Dermatology. A. Kissmeyer. *Acta Radiologica*, 1931, Vol. XII, No. 67, 15, VII, 289-299.

Definition: Grenz (or Bucky) rays lie in the border zone between ultra-violet and the soft X-rays used in superficial therapy. They are electro-magnetic rays of from 1 to 3 Å.U., with a half layer value of 0.015-0.030 mm. of aluminum.

The few, very short X-rays, resembling Grenz rays, contained in the heterogenous bundle of radiation from an ordinary X-ray tube are all absorbed by the glass wall of the tube. For Grenz therapy a special tube must be used with a window of Lindemann glass about 0.1 mm. thick. The maximum voltage that can be used with these tubes is 11 K.V.P.; the maximum current, 10 milliamperes. Voltage affects the absorption of the rays: at 5 K.V.P., the first millimeter of skin absorbs almost all the rays, while at 9 K.V.P. the second

millimeter receives and absorbs most of the rays.

Because air easily absorbs Grenz rays, the distance from the tube-window to the skin must be very short, from 2.5 to 12.0 centimeters. Generally the tube-skin distance and the diameter of the field are the same, *e.g.*, with a tube-skin distance of 5 cm., a field 5 cm. in diameter will receive fairly uniform radiation with the periphery getting 70 per cent as much as the center.

Exact dosage of Grenz rays must be measured in r-units. Each tube must be calibrated before use since there is considerable difference in the output of various tubes. Additional measurements need be made only every four or five weeks, for tubes vary only about 10 per cent from their original output.

The basis for the use of Grenz rays lies in the fact that they are chiefly absorbed by the superficial layers of the skin. The first millimeter absorbs 70 per cent of incident Grenz rays as compared with 5 per cent of ordinary X-rays, and the first 2 mm. of skin absorb 90 per cent of incident Grenz rays. The author states that the undesirable effects following X-ray radiation are due to changes in the subcutaneous tissues. Such lesions do not develop after the use of Grenz rays.

In spite of having the physical characteristics of X-rays, Grenz rays produce very different biologic reactions. After a moderate dose of from 500 to 1,000 r, an erythema appears, following a latent period of from 24 to 48 hours. It is mild, and after three or four days begins to fade. About three weeks after the treatment, the erythema increases again, accompanied by edema of the skin and an appearance strongly resembling an ultra-violet reaction. This, in turn, slowly diminishes. Marked pigmentation develops after the second erythema. Only with very large doses of from 11,000 to 22,000 r, such as are sometimes employed in lupus vulgaris, is there a severe reaction accompanied by actual necrosis. The author states that at the Finsen Institute the tendency is toward smaller doses in all cutaneous Grenz therapy.

Histologically, after moderate doses, the skin shows edema and vacuolization in the

epidermic and lymphocytic infiltration in the corium. It is thought that the skin reaction is accompanied by the production of certain histamin-like substances in the cells of the skin just as in ultra-violet radiation.

The author reports on cases treated at the Finsen Institute prior to September, 1930. The diseases treated are chiefly eczema, psoriasis, and superficial dermatoses. Doses range as follows: (1) In eczema, from 275 to 550 r; (2) in psoriasis, from 365 to 825 r; (3) in lichen simplex, as high as 1,100 r. These doses can be repeated after from three to four weeks. The lesions were treated at a tube-skin distance of from 6 to 12 centimeters.

Of 53 cases of eczema, 17 were cured and 27 improved; 13 recurred and 6 were not affected at all. The author suggests smaller, repeated doses. Of 62 cases of psoriasis, many (exact number not stated) were free of recurrence for several months. Of 16 cases of lichen simplex, two were cured, 12 much improved, and four remained unaffected.

Spiethoff reports good results in superficial angioma with doses of from 1,000 to 4,000 r, and in deep cavernous angioma with doses of 11,000 r. Bucky uses general body radiation and reports interesting results with pruritus ani and vulvæ, vitiligo, loss of hair, and endocrine disorders. He treats the patient daily, using four fields on the anterior body surface and four on the posterior. After a week, he allows a rest day and then repeats the series.

The author regards Grenz rays as a valuable method of therapy in many superficial cutaneous diseases.

A. L. HART, M.D.

Our Experience with Grenz-ray Therapy in Pediatrics. E. Rominger and J. Jochims. *Deutsche med. Wchnschr.*, June 12, 1931, LVII, 1005-1008.

The authors report their experience in 140 children who were treated with long wave length X-rays. The following qualities and quantities of radiation were used: For eczema, 10.7 K.V., 10 ma., H.V.L. in zellon 0.35 mm.; for warts, 11.2 K.V. The F.S.D. in both cases was 4 centimeters. For general

body exposure the F.S.D. was increased to 9.5 cm. at 9.8 K.V. and 10 milliamperes. The eczematous areas received 500 to 600 r. This treatment should not be repeated before three weeks. Smaller but frequently repeated doses were of no benefit. Warts received from 1,000 to 1,500 r at intervals of 14 days. It is necessary to protect the surrounding skin. Hemangioma received from 1,000 to 1,500 r at intervals of from 1 to 3 weeks. For general body exposure the surface of the body was divided into eight fields, each of which received 150 r daily. This was repeated once, with an interval of one day between exposures. In the 140 cases, 4 excessive reactions were seen: two could have been avoided, while two could be explained only by an increased susceptibility. The authors feel that therapy with long wave length X-rays has great advantages in the skin diseases of childhood. They emphasize particularly the low penetration. In eczema their results were most encouraging. It is necessary, of course, to individualize the treatment and not use a schematic procedure for all cases. Besides eczema, pernioles, hemangioma, and infected slow-healing wounds seem to be benefited. No influence could be observed in cases of pertussis and rickets.

ERNST A. POHLE, M.D., Ph.D.

GYNECOLOGY AND OBSTETRICS

The Changes of the Basal Metabolic Rate and the Vegetative Nervous System in Functional Disturbances of the Female Sexual Organs and Their Roentgen Treatment. Felix Gál. *Strahlentherapie*, 1931, XLI, 559-600.

The author has made an extensive study of the basal metabolic rate in functional disturbances of the female sexual organs. He finds that in cases of permanent amenorrhea as well as after surgical or roentgen sterilization a decrease of the basal metabolic rate or a hypothyroidism is the rule. In oligo- and dysmenorrhea, as well as in juvenile metropathy, the characteristic symptom is the sensitization for adrenalin. This reaction is an

excellent indicator for the functional stage of the inner secretory glands. From the therapeutic standpoint, the determination of the basal metabolic rate is of importance because one can easily single out those cases which may be influenced *via* the thyroid.

ERNST A. POHLE, M.D., Ph.D.

Findings in the Hypophysis Following Ovarian Irradiation. J. Borak and F. Windholz. *Klin. Wchnschr.*, 1931, X, 586-589.

A 30-year-old woman with carcinomatous metastases from the breast to the pelvis was given intensive radiation. She was repeatedly irradiated in the course of the next two and a half years, receiving a total of four castration doses. At autopsy, the Graafian follicles of the ovary were found to have disappeared almost completely, but the interstitial tissue was not affected. The hypophysis showed proliferative changes of the eosinophiles in the anterior lobe exactly analogous to the changes observed following ovariectomy.

CHEMICAL ABSTRACTS.

Roentgen Diagnosis in Gynecology and Obstetrics. Irving F. Stein. *Jour. Michigan St. Med. Soc.*, September, 1931, XXX, 675-679.

For eight years the author has been interested in the development of roentgen diagnosis in connection with obstetrics and gynecology and has found it a most useful adjuvant. The Rubin patency test has been one of the most striking advances in gynecologic diagnosis. This has been developed by Peterson into the transuterine or transabdominal pneumoperitoneum which the author has used in over 500 cases without accident or serious complication. Since 1926, this has been combined with the use of iodized oil in many cases.

Of the two methods, if one is to be chosen, the pneumoperitoneum will give the most information relative to pelvic pathology, such as differentiation of ovarian tumors from pregnancy, etc.

In obstetrics, roentgenography is of value in

early pregnancy by combination with pneumoperitoneum for differentiating pregnancy at mid-term from soft fibroids and cysts, for determining multiple pregnancy, before cesarean to determine the presence of a normal fetus, for large or postmature fetus for degree of bone development, in malpresentations, for studying the bony pelvis of the mother, and in teaching obstetrics.

W. W. WATKINS, M.D.

A Review of the Radiation Treatment of Non-malignant Lesions of the Female Pelvis. Lewis G. Allen. *Jour. Kansas Med. Soc.*, February, 1931, XXXII, 37-40.

A consideration of the application of radiation therapy to non-malignant lesions of the female pelvis and a review of the literature impress one with the fact that the possibilities of safe, economical, positive results to be obtained by radiation therapy are not generally appreciated or are being neglected. Schmitz treated only 10 per cent of 142 cases of myomas by radiation, while Bécclère treats all cases by radiation except "cases in which for some urgent reason surgical intervention becomes absolutely necessary." Miller says 30 per cent are suitable for radiation; Ward puts it at from 70 to 90 per cent; Christie says two-thirds of uterine fibroids are amenable to radiation therapy. Other non-malignant lesions for which radiation is applicable include idiopathic menopausal hemorrhage, pruritus vulvæ and pruritus ani, kraurosis, urethral caruncle, endocervicitis.

W. W. WATKINS, M.D.

The Incidence, Diagnosis, and Treatment of Functional Sterility. Charles Mazer and Isaac Andrussier. *Am. Jour. Obst. and Gynec.*, July, 1931, XXII, 46-59.

Involuntary sterility is on the increase, Reynolds and Macomber placing its incidence in this country at 13 per cent and Lotka at 17 per cent in the white American population. The authors in a series of 506 cases of female sterility found that endocrine malfunction was the responsible factor in 25 per cent. The in-

terrelation of the pituitary hormone, female sex hormone, and lutein hormone in the sexual cycle is clearly discussed.

The authors state that they obtained better results in the treatment of functional sterility with X-ray stimulation of the ovaries and pituitary gland than with any other form of treatment. Six of the 38 sterile women with menstrual derangements, thus treated, were delivered of healthy offspring; 19 (or 50 per cent) are menstruating regularly, and seven show marked improvement in the menstrual rhythm. The remaining 12 (or 31 per cent) have not been benefited. The authors found organotherapy to be far less effective than X-ray. They do not give their dosage or technic.

JACOB H. VASTINE, M.D.

HEART AND VASCULAR SYSTEM (DIAGNOSIS)

Sounding the Right Heart. Antonino Perez Ara. *Revista de Medicina y Cirugia*, July 31, 1931, XXXVI, 491-508.

The author introduces here a good review of the literature of this subject. He presents several cases on which he has done right auricular sounding. As he has done this on himself, too, he concludes that the procedure is painless and offers a new therapeutic method of treatment. He prefers the cephalic vein of the left arm and uses a ureteral catheter from 60 to 65 cm. long. All his cases have been controlled under the fluoroscope.

N. G. GONZALEZ, M.D.

Double Aneurysm of the Aorta and its Roentgenologic Appearance. P. Eckel. *Röntgenpraxis*, Sept. 1, 1931, III, 784-792.

The roentgenologic literature presents only a few cases of multiple aneurysm of the aorta, three of which are described by the author. One of them was verified by autopsy.

The first case showed a diffuse saccular aneurysm of the aortic arch and another aneurysm of the descending aorta; the second case had an aneurysm of the ascending and

descending aorta, while the third revealed the aneurysms in the arch and in the ascending aorta. Of much importance for the diagnosis is the connection of the shadows with the aorta and the sharp edges.

H. W. HEFKE, M.D.

Extreme Dilatation of the Left Auricle. David Steel. *Am. Jour. Roentgenol. and Rad. Ther.*, July, 1931, XXVI, 66-73.

The author presents a proven case and reviews the literature dealing with similar cases of extreme dilatation of the left auricle. Rheumatic fever is the outstanding etiologic factor. Changes in the mitral valve, usually in the form of a marked stenosis, were present in every case. The pericardium, likewise, showed adhesions, especially over the left auricle. Since definite physical signs of extreme dilatation are not usually present early, it is important that careful roentgenologic study be made. A positive differential diagnosis from dilated right auricle, encapsulated pericardial fluid, aneurysms of the ascending aorta, and mediastinal tumor can usually be made by this method. The author emphasizes that even in such extreme dilatation as was present in the case reported, the left auricular appendage only contributed to the formation of the left side of the cardiac silhouette, while the entire right side was made up of the greatly dilated left auricle.

J. E. HABBE, M.D.

HODGKIN'S DISEASE (DIAGNOSIS)

Lymphogranulomatosis of the Bones (Hodgkin's Disease). Richard Dresser. *Strahlentherapie*, 1931, XLI, 401-416.

In 1926, the author reported 95 cases of Hodgkin's disease observed during a period of three years in the Massachusetts General Hospital. Only 4 of these (4.2 per cent) showed involvement of the bone. In all these patients the sternum was the seat of the meta-

static process. The second series related in this article comprised 149 patients, 16 of whom had bone involvements (10.7 per cent). The diagnosis was always verified by biopsy of a gland or by microscopic examination of the bone tumor itself. Roentgenologically, the changes in the bones are similar to those produced by a malignant metastatic growth. The spine, pelvis, skull, and sternum are the favorite seats of the pathologic process in the bone. Some cases showed splendid palliative results following X-ray therapy while others did not respond at all. The examiner is urged to look for bone involvement in all cases of Hodgkin's disease.

ERNST A. POHLE, M.D., Ph.D.

An Unusual Case of Hodgkin's Disease.
J. I. Sapwell. *Lancet*, Aug. 15, 1931, CCXXI, 347-349.

The author presents a case which was first seen January 13, 1927, and was hospitalized because of edema of the legs and associated ascites. There were enlarged axillary, occipital, and inguinal glands. The spleen was palpable, as was also the liver after the abdomen had been tapped. On two occasions eighteen pints of chylous fluid were obtained from the abdomen. The blood picture was that of a secondary anemia, with an associated mononucleosis. Eosinophil cells averaged 5.6 per cent. Several weeks after admission, the patient developed a pleurisy with effusion on the left side, and turbid yellow fluid was aspirated.

The patient was seen as an out-patient from April 23, 1927, to April 27, 1928, when she was re-admitted because of edema, ascites, nausea, dyspnea, and cough. Her relapse had started three weeks before. Examination showed signs of fluid in the right chest, ascites, and enlarged liver, but no enlarged glands in the neck or axillæ.

The abdomen was tapped, and on each of two occasions fourteen pints of chylous fluid were obtained. The chest was aspirated and

two pints of chylous fluid were obtained. One month after admission the patient had an attack of tachycardia lasting less than twelve hours, and six days later a similar attack occurred. On June 1, enlarged glands were felt in both axillæ and the left groin, and there was an increase in mediastinal dullness on percussion. On June 5, a biopsy was taken from the chest wall anterior to the right axilla. On June 7, the patient had a suppression of urine which lasted for two weeks to the time of her death. Despite the increasing edema and nitrogen retention, the patient had no uremic manifestations. On June 20, the blood-urea had increased to 197 mg. per 100 c.c. of blood. The patient died suddenly June 22. At autopsy, milky fluid was present in both cavities. The right parietal pleura and left diaphragmatic pleura were thickly infiltrated, having a nodular surface. The visceral pleura over the lower lobes of both lungs was similarly affected. The underlying lung was not affected. A large posterior mediastinal mass completely embedded the aorta and thoracic duct. The peritoneal cavity contained a milky fluid, and the parietal peritoneum was thickly infiltrated. The pedicles and pelves of both kidneys were embedded in a large retroperitoneal mass which surrounded the aorta, the left common iliac, and both renal arteries. The urinary bladder was empty and a wall infiltrated similar to the peritoneum. The liver contained only one pea-sized nodule and the spleen was not involved.

Histology of the gland removed at biopsy presented a picture of Hodgkin's disease. The section from the retroperitoneal mass presented a picture closely conforming with Ewing's "Hodgkin's endothelial sarcoma." The spleen, which was not enlarged, presented a picture of tuberculosis; however, the alternative of milary gummas was possible.

There is a detailed discussion and a summary of the notable features of the case.

The author first made a diagnosis of lymphadenoma of the "deep" type, that is, affecting the deep lymphatic glands predominantly. A final diagnosis following the biopsy was made of Hodgkin's disease.

F. L. GRANDSTAFF, M.D.

THE KIDNEY

Elimination of the Kidney Function When Irradiating a Fistula of the Ureter. H. von Spindler. *Strahlentherapie*, 1931, XLI, 336-340.

Roentgen exposure of the kidney for the treatment of a fistula of the ureter has been tried successfully. About 90 per cent E.D. of heavily filtered radiation stopped the secretion. The author contends that this would indicate a high radiosensitivity of the kidneys, and if this is so, great caution should be exercised in irradiating the kidney region with heavy doses. He quotes several cases of his own in which high doses over the kidney did not interfere with the normal function for several years. On the other hand, fistulae did close following roentgen therapy. Nothing can be said, however, so far, as to the mechanism of this therapeutic action of roentgen rays.

ERNST A. POHLE, M.D., Ph.D.

Perinephritic Abscess: A Roentgenological and Clinical Study. Leo G. Rigler and M. H. Hanson. *Am. Jour. Surg.*, September, 1931, XIII, 459-467.

Nineteen cases of perinephritic abscess, proved by operation or postmortem examination, are reported. Of these, sixteen were extra-renal and two renal in origin, while one was doubtful. Eleven cases were examined with the roentgen ray.

These cases illustrate the common errors in diagnosis and, because of the failure to diagnose it correctly, the usual long delay in the treatment of this condition.

Roentgen examination may be helpful in arriving at an earlier diagnosis of perinephritic abscess.

The most important roentgen sign is a loss of the normal psoas muscle and kidney shadow. Upward displacement of the diaphragm and evidence of displacement of the colon are next in importance. Scoliosis of the spine is of least importance.

The X-ray signs are frequently absent or

doubtful as long as ten days after the onset of symptoms. However, they are almost always present within fourteen days.

Six cases are reported, including appendiceal abscess, abdominal tumor, pyonephrosis, polycystic kidney, and psoas abscess, in which the roentgen signs of perinephritic abscess were closely simulated. The X-ray findings are, therefore, valuable only as suggestive or corroborative evidence of the condition. Absence of the roentgen findings after a period of fourteen days from the onset should throw grave doubt upon the diagnosis of perinephritic abscess.

DAVIS H. PARDOLL, M.D.

Results of Nephropexy by Marion's Method, Controlled by Pyelography. Juan Salleras. *Semana Méd.*, June 19, 1930, XXXVII, 1545-1552.

The author presents six cases operated upon by this method, which were followed from two to eight months post-operatively. In order to compare the therapeutic results, pyelograms were taken before and after operation. He believes that pyelograms are not only necessary in nephroptosis to determine the amount of ptosis but also as a differential diagnosis between acquired renal ptosis and congenital malformation. He goes into detail in each case, presenting the pyelograms taken before and after, as well as the clinical symptoms pre- and post-operatively. Judging by this article, the operation is a very successful one.

N. G. GONZALEZ, M.D.

Resection of the Kidney: Report of Six Cases. N. P. Rathbun. *Am. Jour. Surg.*, September, 1931, XIII, 565.

The author reports six cases in which resection of the kidney was performed. He observes that this procedure is best adapted to pathologic lesions associated with congenital anomalies, such as, for example, horseshoe kidneys, bifid pelves, etc. Resection has, however, a place in some cases not associated with congenital anomalies, for instance, benign tu-

mors, solitary cysts, and calculous pyonephrosis involving one pole of an otherwise fairly good kidney. Resection should never be employed for malignant tumors or tuberculosis in any kidney not the seat of a congenital malformation. The special dangers incidental to the operation are hemorrhage, primary or secondary, infection, and persistent urinary fistulae.

The article is accompanied by résumés of the cases and several pyelograms.

DAVIS H. PARDOLL, M.D.

MEASUREMENT OF RADIATION

The Dependence of the Wave Length of Small Ionization Chambers. III.—Spheric Chambers. Heinz-Theodor Meyer. *Strahlentherapie*, 1931, XLI, 309-320.

The author studied the dependence of the wave length of small ionization chambers of different volume. He comes to the conclusion that in order to obtain independence of the wave length in small ionization chambers, the number of atomelectrons contained in the unit of volume of the chamber material is not the sole controlling factor, but the ratio of chamber surface to chamber volume must also be considered.

ERNST A. POHLE, M.D., Ph.D.

Intensity Measurements in the Carbon Arc. V. Thorsen. *Strahlentherapie*, 1931, XLI, 647-709.

The author carried out a very detailed study of the carbon arc by means of thermo-electric methods, particularly as to the output in its relation to current and potential. He found that by differentiating between arc and crater radiation the former (CN band emission) follows very definite and simple laws which were qualitatively the same for three different types of carbons. The results of this highly technical investigation are presented in detail in numerous tables and graphs.

ERNST A. POHLE, M.D., Ph.D.

RADIATION (THERAPY)

The History of the "Langzeit" Irradiation (Method of the Protracted Fractional Roentgen Therapy). H. Holthusen. *Strahlentherapie*, 1931, XLI, 435-449.

The author relates in this historical sketch the development of the methods of application of roentgen rays in therapy. The single massive dose method is contrasted with the fractional dose method as practised particularly by Coutard (Paris). Although one can easily show from a study of the literature that every principle used in Coutard's method has already been employed by some roentgenologist in the past, the combination of fractional doses with the extension of the treatment over a long time is a development originating in the Paris Institute. It has been rightfully named the protracted fractional dose method. According to our present conception, the application of higher doses is possible in this manner as compared with the single dose method, without seriously injuring the tissue surrounding the tumor.

ERNST A. POHLE, M.D., Ph.D.

Radiation in Carcinoma of the Breast. Ira H. Lockwood. *Jour. Arkansas Med. Soc.*, August, 1931, XXVIII, 51-55.

The resources now available against carcinoma of the breast are surgery and radiation, both of which require the co-operation of the patient. These resources are efficient in proportion to the discoverability of the carcinoma, the location of the lesion, the stage of advancement, and the ability available to diagnose and treat the case. The conception of operability is not whether the lesion is removable, but whether or not the removal is going to cure the patient. The inoperable cases comprise two-thirds of the primary carcinomas of the breast.

Radiation therapy, both radium and X-ray, has a distinct place in the treatment of carcinoma of the breast. Better and more lasting results will be obtained if the surgeon will

adopt a better conception of operability and become more conversant with the possibilities of the radiation method of treatment.

W. W. WATKINS, M.D.

Roentgen or Thallium Epilation in Cases of Mikrosporia. Carl Speierer. *Strahlentherapie*, 1931, XLI, 395-400.

The author comes to the conclusion that thallium acetate cannot affect in any way the mikrosporon even after complete epilation. The micro-organisms remaining in the scalp are not destroyed. Therefore, the new growing hair can be again infected. Although roentgen rays do not kill the mikrosporon they apparently devitalize the remaining micro-organisms enough so that they slowly disappear. The roentgen epilation is, therefore, the method of choice.

ERNST A. POHLE, M.D., Ph.D.

Total Body Exposure in Skin Diseases. Karl Weber. *Strahlentherapie*, 1931, XLI, 286-295.

Fifty-five patients (22 with psoriasis, 30 with eczema, 2 with lichen ruber planus, 1 with neurodermatitis) were treated by total body exposure to roentgen rays. The single dose amounted to 15 r (120 K.V., 4 ma., 3 mm. Al, H.V.L. in Cu, 0.15 mm. in Al 3.64 mm.; 160 cm. F.S.D., diameter of field about 130 centimeters). Every second day the anterior and posterior surfaces of the body were exposed alternately up to eight exposures. After an eight days' interval another four treatments were given, i.e., within four weeks a total of 12 body exposures. In only 9 cases was leukopenia observed. In one patient the number of leukocytes dropped to 2,700 but returned to normal after from six to eight weeks. It is noted that none of the patients with leukopenia developed X-ray sickness; on the other hand, all patients who had X-ray sickness did not show leukopenia. One woman, 43 years of age, who had not menstruated for two years, menstruated again after the treatment. In young women the menstruation occurred earlier than usual. The ovaries were,

therefore, covered in a later series in order to avoid their direct exposure. A total of 25 cases (10 of psoriasis, 12 of eczema, 1 of neurodermatitis, 2 of lichen ruber planus) were cured. Fourteen (5 of psoriasis, 9 of eczema) were improved and 16 (7 of psoriasis, 9 of eczema) did not show any benefit at all.

The author concludes that the results are so gratifying that there seems to be a definite field of general body exposure in skin diseases. This holds particularly for chronic cases that have failed to respond to local irradiation. They should by all means be given a trial with this method.

ERNST A. POHLE, M.D., Ph.D.

Résumé of the Principles of the Technic of Roentgenotherapy in Deep Cancer. H. Coutard. *Arch. Radium Institute, University of Paris and Curie Foundation*, 1931, II, Part 3, 359-370.

Between the method of treatments prolonged over three to four months, and more, by successive series, and the method of rapid treatments in which the irradiation is condensed into the shortest possible time, the author, taking the works of Regaud as a basis, uses a method of treatment of which the essential characteristics are the following: The search for as selective an action as possible on the neoplastic elements, by the use of radiation as penetrating as possible, and the increase of the interval between the degrees of radiosensitivity by suitably arranging the time of the séances of irradiation which constitute a single treatment.

By this method of treatment, which has been applied since 1919, 28 per cent of cures have been obtained (22 patients living out of 77 treated) in epitheliomas of the larynx, treated from 1921 to 1926.

B. J. DE LAUREAL, M.D.

What Rôle has Roentgen Therapy in the Treatment of Surgical Tuberculosis? V. Schiller and W. Altschul. *Strahlentherapie*, 1931, XLI, 755-761.

The authors state that roentgen therapy is indispensable as an auxiliary method in the

treatment of surgical tuberculosis. A number of case histories illustrates their contention. The usual general treatment of tuberculous patients must, however, not be neglected.

ERNST A. POHLE, M.D., Ph.D.

Roentgen-ray Treatment of Blood Diseases. I. T. Fugate. Kentucky Med. Jour., August, 1931, XXIX, 399, 400.

The group of diseases known as lymphoblastomas is, with reservations, amenable to X-ray treatment, though the final end-results are almost always unsatisfactory. The roentgenologist should make sure that his treatment does not aggravate the disease. It may be said that the individual lesions respond readily to treatment, but the disease itself does not always do so.

W. W. WATKINS, M.D.

A New Method of X-ray Treatment of Leukemia. T. Dale. Acta Radiologica, 1931, Vol. XII, No. 67, 15, VII, 263-286.

For a long time radiation has been the best method of treating leukemia. On the average, 50 per cent of the cases so treated have remission of symptoms and regain their ability to work, while only about 6 per cent of untreated patients do so.

Localized radiation over the spleen or long bones has been the usual method of treatment. From reports of various radiologists the author deduces that when the long bones are radiated, the reduction in the white count proceeds more slowly but is likely to last longer than when the spleen alone is treated.

For two years the author has been treating cases of leukemia by a somewhat different method, employing small daily doses of radiation over the entire body from a greater distance. Theoretically, the advantages of this method might be summarized as follows: (1) The bone marrow will receive small doses of radiation, thus tending to prevent the development of anemia; (2) with daily doses over a long period of time and a large body surface, a larger number of white blood cells would be affected; (3) less general reaction

should ensue than in heavy radiation of the spleen; (4) in radiating the whole body, it may be possible to affect the organ or organs primarily at fault in leukemia.

The author's technic is as follows: target-skin distance, one meter; filter of 0.5 mm. zinc; 2 ma.; time from 12 to 18 minutes daily for about five weeks. The author does not state the voltage expressly, but judging from the context, it is probably from 180 to 200 K.V.P. In a series covering five weeks, about 0.8 H.E.D. is given in all. The patient's head, neck, and genitals are protected by lead. The radiation is applied to the anterior and posterior surfaces of the body on alternate days.

The author reports the following: (1) Myelogenous leukemia in four cases which had had previous radiation of the spleen with poor results; (2) myelogenous leukemia in four cases which received only general body radiation; (3) lymphatic leukemia in two cases which received only general radiation. Of the first group, all died after a temporary improvement in general condition and in white count. In the second group, two patients died and two are still alive. The two living have been under control for 18 and 15 months, respectively, in good general condition and able to work. One is a woman of 68 years whose white count before treatment was 606,000 and whose last count before publication of this article was 13,700. The other is a man of 51 years whose first white count was 235,000 and whose last published count was 15,600. In the third group, one patient is dead and the other has lived 23 months since radiation was started and is still in good general condition. His white count before radiation was 430,000, the last count published being 17,000.

The author recommends checking up the blood count every month and starting radiation again as soon as the white count shows a tendency to rise.

A few German radiologists, among them Teschendorf, have reported in the last few years the treatment of leukemia by general body radiation. A few large doses were given and, although the white count fell, the patients often had severe general reactions lasting several days. The author, on the contrary, has

had no severe general reactions in his cases and regards his method as entirely safe.

The author does not contend that general body radiation will cure leukemia but he does believe, from his own experience, that it gives better results than treatment of the spleen or lymph nodes alone. By making a white count each month and giving a short series of radiation whenever the white cells begin to rise, patients have been kept in good general condition and able to work for longer periods than with the older method of treatment.

A. L. HART, M.D.

Lead Screens for Use on Patients in Radiation Therapy. A. Pokorny and L. Pokorny. *Strahlentherapie*, 1931, XLI, 767-770.

A method is described which permits the adaptation of lead protective covers to complicated surfaces, as, for instance, the face, in radiation therapy. By means of plaster of Paris, a model of the area to be treated is made and the lead screens molded accordingly.

ERNST A. POHLE, M.D., Ph.D.

On General Body Exposure with Roentgen Rays. W. Teschendorf. *Deutsch. med. Wchnschr.*, 1931, LVII, 1445.

The author relates in this article his experience with total body irradiation in leukemia. He uses 170 K.V. eff. copper filter, producing an H.E.D. in 30 minutes. In one sitting, from 6 to 10 min. at from 180 to 200 F.S.D. were applied over the anterior and posterior body. If there are no severe reactions, a blood count is taken on the eighth day. If the leukocytes are still dropping, it is best to wait until the lowest count has been reached; then the treatment may be repeated.

A number of case histories are appended, showing in graphic form the data on treatments and blood. In aleukemia, the method was also of benefit, but in Hodgkin's disease no definite results could be obtained.

Some clinics have used the same treatment method in skin diseases. The author feels

that only in cases with very extensive involvement of the skin or in extremely chronic lesions, which do not respond to the usual therapy, should general body exposure be given a trial.

ERNST A. POHLE, M.D., Ph.D.

The Significance of the Infra-red Spectrum for the Anti-rachitic Substances. Walter Hirsch and Lotte Kellner. *Strahlentherapie*, 1931, XLI, 232-250.

From a study of the literature one may conclude that there is an anti-rachitic effect of short and long light rays on ergosterol. Since only biologic tests support this conclusion, the authors investigated the effect of well-defined infra-red radiation on ergosterol activated before by ultra-violet rays using the spectroscopic method. A 0.2 solution of ergosterol in absolute alcohol was exposed to the quartz mercury vapor lamp at 20 cm. distance. The exposure times amounted to 5 minutes, 30 minutes, and 2 hours in order to produce the various active substances. The 30-minute-exposure time produces the maximum of anti-rachitic substances, while the 5-minute and 2-hour products contain about 50 per cent less. The three substances can well be differentiated by their absorption spectrum. Immediately after the ultra-violet exposure half of the exposed solutions were irradiated by light sources with infra-red spectrum: A 500-watt nitra lamp (infra-red maximum at 10,000 Å.), the Nernst lamp (infra-red maximum at 23,000 Å.), and the heat sun (infra-red maximum at 50,000 Ångströms). It appeared that an increase of temperature of 10° C. was sufficient to change the ultra-violet absorption spectrum of the anti-rachitic substance so that the absorption was generally increased. Besides the heat effect the irradiation with infra-red light has also a specific effect. One must differentiate, however, first, an increase of the absorption in the region of from 2,600 to 3,000 Å., which means that the anti-rachitic effect is more or less decreased, and, second, the influence of the infra-red radiation on the absorption in the short ultra-

violet region from 2,300 to 2,600 Ångströms. The increase of temperature leads to a decrease in the absorption. Besides that there is a specific effect of the infra-red which increases the absorption. In this spectral range that means an increased formation of anti-rachitic substance. If ergosterol was exposed to ultra-violet and infra-red simultaneously it was activated quicker. The authors feel that besides the ultra-violet there are other spectral regions which are of importance for the anti-rachitic substances.

ERNST A. POHLE, M.D., Ph.D.

RADIUM

A Biologic Reaction to Scattered Radiation. D. Goulston. *Med. Jour. Australia*, July 18, 1931, II, 74-76.

The site of maximum response of the chorio-allantoic membrane of the chick, exposed through a window in the shell to the radiations of a radium needle, does not correspond to the site of maximum radiation. The reaction does not develop directly beneath the needle, but only along lines parallel to it and at varying distances from it. Another curious fact is that a 3-mg. needle placed in contact with the shell for 96 hours, no window being made, does not induce any change in the underlying chorio-allantoic membrane. The mere making of a window as a control has no effect.

When a long, narrow window is made, the width being not much greater than the diameter of the needle which is placed along it, the reaction develops along the entire length of the exposed membrane.

The conclusion is drawn, therefore, that the tissue is sensitive to some radiation from the edge of the shell window, the area and intensity of the reaction depending on the relation of the radium to the shell window.

Still more interesting is the fact that, when a lead window is placed over the egg-shell window in contact with the egg so that the apertures in shell and lead sheet coincide, no reaction develops in the chorio-allantoic membrane. The substitution of an aluminum win-

dow, however, gives a striking "degenerated area" for the same conditions of irradiation. A copper window gives a hypertrophic reaction. Photographs and microphotographs illustrating these appearances are given and the explanation is offered that the effects arise from the scattered radiation from the edges of the windows.

The work has been carefully done and is of unique interest.

Reference should also be made to the author's first paper in the same publication, March 21, 1931.

J. G. STEPHENS, M.D.

Radium Treatment without Filter by Means of Radium Points. M. Heiner. *Strahlentherapie*, 1931, XLI, 785-798.

Since 1927, the author has used radium points (A. Fischer) in the treatment of malignant tumors. They consist of a platinum radium compound which carries part of the radium so close to the surface that not only alpha-, beta-, and gamma-rays are emitted, but also a considerable amount of radon. Platinum wire carrying from 0.1 to 2.6 mg. radon element was used. It is necessary to implant these points so as to avoid necrosis. Depending on the seat of the disease, the points may remain from four to 100 hours in the tissue. Among 100 cases treated, no single case of necrosis could be observed. Sixteen case histories are appended.

ERNST A. POHLE, M.D., Ph.D.

ROENTGEN INJURIES

Errors in Rendering Opinion in Cases of Roentgen Injuries. A. Reisner. *Deutsche med. Wchnschr.*, 1931, LVII, 1539.

The author relates two medico-legal cases which illustrate strikingly the possible pitfalls of an expert opinion rendered without personal examination of the patient.

The first case is that of a man who, in December, 1927, developed a skin disease on the heel probably following an injury to the heel in an accident. He received X-ray

therapy twice at an interval of eight days. The records of the treating physician showed that 40 F units through 1.0 mm. Al were given. Shortly after the treatment, there was a hardening of the tissue in the irradiated area with white discoloration and exudation. The ulceration extended far beyond the exposed area to the right calf. Examination of these lesions showed a typical syphilitic ulceration which certainly did not reveal any signs of X-ray injury. Further questioning of the patient verified this diagnosis.

The second case is that of a woman who had a small red nevus on the right lower arm. Early in 1927 the nevus seemed to enlarge and became inflamed. The woman received, in May, 1927, X-ray deep therapy at ten-day intervals; each time a dorsal and a volar field was exposed. The day following the second treatment, she reported that blisters, which required treatment for several weeks, appeared in the irradiated area. Examination of this patient revealed lesions, which were typical for lupus vulgaris, at the lower third of the right arm. A few telangiectases were present in the exposed areas. The treatment had originally been given because the referring physician made a diagnosis of eczema.

Neither of these two cases is, in the author's opinion, entitled to compensation.

ERNST A. POHLE, M.D., Ph.D.

SKIN (GENERAL)

Anatomical Factors Influencing Malignancy of the Skin of the Face. Paul O. Snoke. *Surg., Gynec. and Obst.*, August, 1931, LIII, 196-201.

The author states that "too much emphasis is being laid upon the histopathologic grading of carcinoma," and in carcinoma of the skin of the face anatomic factors are of importance. He places them in four groups:

Group 1: Underlying bone—

Internal canthus,

Malar prominence.

Group 2: Underlying fascia—

Below the external auditory meatus,

Over the temporal region.

Group 3: Underlying dense integumentum—

Angulæ alæ nasi,

Forehead and scalp.

Group 4: Underlying cartilage—

Skin of nose,

Lower eyelid. Tarsal plate.

Each of these headings is discussed and the suggestion as to result is given.

DONALD S. CHILDS, M.D.

SKULL (DIAGNOSIS)

Encephalography: An Explanation of a Possible Error in Technic. Eugene P. Pendergrass. *Am. Jour. Roentgenol. and Rad. Ther.*, June, 1931, XXV, 754-757.

In the past the author has made diagnosis of advanced atrophy of the cortex after encephalography in patients showing a large accumulation of air at the vertex and under the tentorium. However, repeated examination on an individual showing this appearance on the first examination but essentially normal encephalographic appearances on re-examination justifies the conclusion that in the first case the air was subdural in location while on the second examination it was subarachnoid. While one possible explanation of the apparently abnormal distribution of air in the first instance is that injury may occur to the arachnoid membrane at the base of the skull during drainage of the fluid and manipulation of the head, with escape of air into the subdural spaces, the author leans toward another theory. He believes that occasional sufficient injury to the arachnoid about the cauda equina at the site of lumbar puncture allows escape of fluid from the subarachnoid into the subdural space, with collapse of the arachnoid and subsequent injection of the air, chiefly into the subdural spaces.

J. E. HABBE, M.D.

A Consideration of Craniocerebral Injuries. H. E. LeFever. *Ohio St. Med. Jour.*, May, 1931, XXVII, 371-375.

X-rays in cranial injuries are of great value in the accurate diagnosis of fractures of the

skull, but it is only in the occasional patient having brain injuries that X-rays are of any great aid in treatment. All cranial injuries of any severity should have X-ray examinations, but in the more serious acute injuries, to insist on X-ray examination to the extent of delaying the institution of treatment is not only poor judgment but an extremely dangerous procedure. In treating head injuries, the important thing is not so much to ascertain the presence of a fracture and its location and extent (except depressed fractures) as to lessen the effects of cranial trauma upon the intracranial contents.

W. W. WATKINS, M.D.

Xanthomatosis, with Defects in the Cranial Bones. J. Frimann-Dahl and R. Forsberg. *Acta Radiol.*, 1931, XII, No. 67, pp. 254-262.

A case is reported, the twenty-fourth described in the literature, of the syndrome characterized by defects in the cranial bones, exophthalmos, and diabetes insipidus, first recognized by Schüller, in 1915.

The patient described was a girl fourteen years old, with unilateral exophthalmos, diabetes insipidus, retarded growth, gingivitis, and characteristic "map-like" defects in the cranial bones. There was also a definite increase in the cholesterol content of the blood.

The literature on the subject is briefly reviewed and discussed.

MILTON J. GEYMAN, M.D.

THE SPINE (DIAGNOSIS)

Spina Bifida Occulta with Urinary Symptoms. H. V. Findlay. *Jour. Urol.*, July, 1931, XXVI, 147-152.

Spina bifida occulta is not uncommonly encountered in a routine physical examination or in X-ray studies of the pelvis and lower spine. The author wished to report this case because the patient failed to develop any symptoms until he was nearly thirteen years old, and because the sequence of symptoms

demonstrates the progressive development of this type of lesion in some patients.

Symptoms in early childhood may be due to abnormal development of the sacral foramina, through which the nerves pass, or to a primary nerve damage. The symptoms which develop later in a spina bifida occulta may occasionally be due to direct trauma over the open spinal canal. They are commonly due, however, to pressure resulting from fibrous tissue which forms in an attempt to close the space between the gaping laminae, thereby protecting the terminal cord. This fibrous tissue frequently involves the nerve trunks and pinches them. A superficial fat pad resembling a lipoma often develops over the spinal defect as an added protection.

DAVIS H. PARDOLL, M.D.

Accidental Puncture of the Cerebrospinal Canal. E. E. Topliff and J. S. Daly. *Canadian Med. Assn. Jour.*, June, 1931, XXIV, 836-838.

Seven cases of accidental puncture of the meninges of the cerebrospinal canal with no injury to the cord have been reported. Six of these were collected by Mathieu, in 1902, and Heger reports a case in 1913. This case reported by the authors is the eighth.

The patient was a female child, aged two years, who, on June 26, 1930, sustained an injury to her back when she fell backwards from the bed to a small table, cutting her back with a piece of glass from a broken lampshade. Within a few hours serous fluid began to ooze from the wound, which was found to be cerebrospinal fluid. This drainage of fluid continued copiously. In ten days the child became quite ill, with restlessness, fever, stiffness of the neck, and vomiting. A smear from the wound showed short chain streptococci. Antistreptococcal serum was given with good results. Three days later the child became unconscious. The wound was probed and two pieces of glass removed. Under active treatment the condition improved slowly. The secretion of fluid was excessive, while each time the fluid lessened, the symptoms became ag-

gravated. Frequent probing of the wound with increase in the flow of fluid was necessary during convalescence.

A review of the seven other cases reported showed striking similarity in the recurrence of symptoms when the wound was allowed to close and the secretion stopped. In only one case did the suturing of the wound lead to primary union without any symptoms of cerebral compression. In explanation of this, it is stated that investigations have shown that any irritation of the meninges, even if aseptic, in opening of the subarachnoid space, causes not only a hypersecretion of the cerebrospinal fluid but the composition of the fluid is changed, pointing to an inflammation of the pia mater. This hypersecretion results in symptoms of cerebral compression.

L. J. CARTER, M.D.

Spondylitis Deformans. Charles W. Buckley. *British Med. Jour.*, June 27, 1931, No. 3,677, pp. 1108-1112.

After a radiologic study of 150 cases of spondylitis treated at the Devonshire Hospital for Rheumatic Diseases, the author subdivides these cases into (a) spondylitis ankylopoietica, (b) spondylitis osteo-arthritis, and (c) other types, including healed or quiescent tuberculosis and Kummell's disease.

(a) In spondylitis ankylopoietica, he concludes that the most striking feature in a large portion of the cases is osteoporosis of the vertebral bodies, and often of the ilia and sacrum. It is frequently of extreme degree, being the primary change, as far as can be detected by X-rays, and precedes any alteration in the ligaments.

Inflammation of the joints between the articular processes arises early and leads to marked tenderness of the spine on pressure or percussion. Ossification of the capsules of these joints, of the ligamenta subflava, and of the interspinous ligaments, quickly follow, and the spine becomes rigid.

Ossification of the intervertebral disks is the common change in man, affecting the outer fibrous laminae but not the central portion. This gives rise to an appearance suggesting

an extension of the anterior common ligament round the sides of the bodies and its ossification. The bodies themselves tend to become constricted in the middle and spread at the edges, with the appearance described by Krebs as "bamboo-like," but exostoses do not form, and this is a most important diagnostic point. The articular processes become firmly ossified (often also the spinous processes), the bodies are joined together by the ossified disks and ligaments, and the spine becomes a rigid bar.

When the dorsal region is affected, either primarily or by the upward spread of the disease, the changes are modified by the difference of the curve; kyphosis develops early, but is never extreme; the posterior ligamentous structures ossify to meet the strain, ossification often involving the anterior and posterior common ligaments; the costo-vertebral joints are implicated early, and respiration soon becomes entirely abdominal. Intercostal pain is a common symptom, and ossification of the ribs to the vertebrae takes place.

Lipping of the anterior edge of the bodies often occurs as a result of the pressure, which is naturally greatest on the concave aspect of the curve; the greater the kyphosis the more marked will be the lipping. The disks become thinned and lenticular in shape, and union soon takes place at the edges of the bodies. When the lower cervical vertebrae are affected, the weight of the head causes compression of the bodies, and an extreme degree of kyphosis is apt to develop. To compensate, the head is hyperextended and the bones become ankylosed in this position, characteristic of the Bechterew type. The atlanto-axial joint often escapes, and thus rotation of the head is retained, but there is usually well-marked thickening and ossification of the anterior common ligament.

If the disease starts in the lower spine, the sacro-iliac joints soon become completely ankylosed. The hip joints quickly follow suit, and will be fixed in extension or flexion, according to the position usually taken up by the patient. The small joints of the limbs are not often affected.

(b) Spondylitis osteo-arthritis is of the same nature as osteo-arthritis of other joints.

In spondylitis osteo-arthritis we have all grades, from slight lipping of the bodies of the vertebræ to the formation of very large exostoses, which, in some, become joined to form bridges between adjacent vertebræ—a form of union which is quite different from that occurring in spondylitis ankylopoietica.

(c) In healed and quiescent tuberculosis, it is not uncommon for several vertebræ to be affected and to present an appearance resembling the osteo-arthritic form.

In Kummell's disease, or spondylitis traumatica, after an injury to the back, from which recovery seems to be normally rapid, the symptoms of pain and stiffness reappear and a slight kyphosis develops. This is due to the breaking down of the cancellous tissue of the body of the injured vertebra, which is crushed and becomes wedge-shaped.

WALLACE D. MACKENZIE, M.D.

Fractures and Dislocations of the Spine: A Review of Fifty Consecutive Cases. Andrew P. MacKinnon. *Can. Med. Assn. Jour.*, July, 1931, XXV, 35-44.

The object of this paper is to show that if fractures of the spine are recognized early and treated adequately neither sudden death, nor life-long invalidism, should result from them.

Forty-five of these patients were males and five females, the youngest being nine and the oldest sixty-eight. The patients were examined at different periods of time after the accident, from two hours to twenty-five years. Forty-three of them were living when last heard of.

The commonest site of fracture is near the thoracico-lumbar junction, the next most common site being in the cervical region, while fracture of the thoracic spine above the level of the eleventh thoracic vertebra is of infrequent occurrence.

One frequently sees reference to the increased number of serious fractures resulting from the newer methods of transportation. It is interesting to note that in the case of only ten of these patients could the accident be attributed to motor cars, while nineteen were injured by horses or horse-drawn vehicles,

two by trains, and two by handcars. A fall from a height was responsible in fourteen patients, while the balance were injured by falling material.

The signs and symptoms have been so varied that they do not lend themselves to analysis except in the case of the thoracico-lumbar group. But as over half of the cases of this series were fractures of the latter group, a study of signs and symptoms is interesting. In the twenty-eight cases in this group one-half showed no neurologic symptom or sign, except pain. In some the sensory symptoms predominated. In others the signs were mostly those of an upper motor neurone lesion, while others presented mainly bladder symptoms.

The diagnosis may be easy or difficult. The history is important, but may lead us astray. It must be remembered that a very slight trauma may cause a fracture or a dislocation of the spine. A history suggestive of fracture may be obtained from many patients who turn out to have had osteo-arthritis, aggravated by injury. Similar mistakes may occur in connection with Pott's disease.

The physical examination may or may not make the diagnosis. It should be as complete as possible for two reasons: (1) Because many of the physical signs may be missed, only to show up on later examinations, thus deceiving the examiner or leading him to believe that a progressive lesion is present, and (2) only after a thorough physical examination has been carried out can the surgeon give satisfactory directions for the X-ray examination.

The final diagnosis must often depend on the X-ray examination. A stereoscopic antero-posterior, with film shift in the vertical line and a single lateral, should always be taken. A fracture of the third lumbar might be easily missed in an antero-posterior plate alone.

The treatment consists of manipulation into position under a general anesthetic, followed by fixation with an apparatus that will permit of immobilization, and efficient nursing care during the long period that must elapse before the bones become consolidated. The fusion operation is not often advisable or necessary on recent cases, although it may be

necessary in old cases in which there is much pain which is relieved by rest.

L. J. CARTER, M.D.

THE SPINE (THERAPY)

Pathology and Roentgen Therapy of Syringomyelia. L. J. Czerny and J. I. Heinismann. *Ztschr. Neurol.*, 1930, CXXV, 573-614. Abstracted in *Zentralbl. f. d. ges. Radiol.*, Dec. 12, 1930, IX, 618.

The effect of roentgen therapy of syringomyelia was first demonstrated by Raymond, in 1905. Roentgen therapy is the best and, in fact, the only therapeutic method which relieves the symptoms and brings the disease process to a standstill. Seventy-five per cent of cases are affected favorably; usually the earlier the case the better the result.

The mode of action is through destruction of the gliomatous tissue, thus relieving the pressure on the nerves. The author treats the spine from both sides, angling 45°, from one-half to three-fourths H.E.D. being given in two or three sittings. Treatment must be carried out for a long period of time. The interval between series should gradually be increased from one and a half to three months in the first year, to four or five series a year later.

H. C. OCHSNER, M.D.

SYPHILIS

Laboratory Aids in Surgery of the Bones and Joints. Charles F. Geschickter. *Jour. Lab. and Clin. Med.*, May, 1931, XVI, 795-822.

The author illustrates the relationship between the various laboratory procedures, not only with surgery but to one another. Several interesting cases are presented, with accompanying laboratory findings. Such statements as the following appear: "No study of a bone lesion is complete without the blood Wassermann report. . . ."

Two cases of syphilis of the fibula are presented, both of which were erroneously re-

sected because the roentgen picture simulated primary bone tumors. The tuberculin test, biopsy, blood culture, direct examination of sinus discharges for mycotic infections, the roentgenogram, and blood chemistry are evaluated and properly illustrated by case records, roentgenograms, and photomicrograms.

A. O. HAMPTON, M.D.

Syphilis as a Pathogenic Factor in Gastric Disturbances. Ismael Angulo Alvarez. *Rev. Méd. Cubana*, September, 1931, XLII, 1018-1033.

The author states that gastric syphilis is more common than most physicians think. He believes that whenever a gastric lesion, whatever it is thought to be, does not respond to the usual therapy, antisyphilitic treatment should be tried out. He reviews the literature on the subject, considering the symptoms, clinical and radiological findings, and treatment. He presents three cases he has attended, and concludes that syphilis may act directly on the stomach or indirectly through the vegetative nervous system.

N. G. GONZALEZ, M.D.

The Value of Roentgenography in the Diagnosis of Congenital Syphilis. Infants Considered. Edward C. Vogt. *Am. Jour. Roentgenol. and Rad. Ther.*, July, 1931, XXVI, 96-101.

The bony X-ray findings in 104 cases of clinically proven congenital syphilis in children under one year of age were carefully analyzed by the writer. X-ray evidence was classified somewhat on the basis of the Wassermann reports, that is, with characteristic roentgen appearances. The findings were listed 4 plus, with changes considered probably due to syphilis. They were considered 3 plus, suggestive appearances were classified 2 plus, and changes considered probably not syphilitic were listed 1 plus. On the basis of this classification 71 per cent of the clinically proven cases were roentgenologically 4 plus, 14 per cent were 3 plus, 5 per cent were 2 plus, and 2 per cent were 1 plus.

Periosteitis, usually multiple and bilateral, was present in 78 per cent of the cases. Osteomyelitis, usually at the ends of the diaphyses, was found in 63 per cent. About 25 per cent of the cases which had skull roentgenograms showed either slight erosion along the lambdoidal or posterior sagittal sutures or slight thickening of the vault; all which showed skull changes revealed changes also in the long bones. Roentgenologic evidence of the disease usually disappeared within several months of antisyphilitic therapy.

J. E. HABBE, M.D.

Roentgen Diagnosis of Congenital Syphilis. G. J. Landa and V. P. Panov. *Ann. de Dermat.*, 1930, I, 867-872. Abstracted in *Zentralbl. f. d. ges. Radiol.*, Dec. 12, 1930, IX, 597.

Radiologically, demonstrable bone changes are found in 78 per cent of congenital syphilis in the first year of life. A severe osteochondritis is the typical early change, being regularly found in dead syphilitic infants. Ossifying periostitis is found in the third or fourth month and is the typical manifestation in late infancy. The site of predilection is the lateral surface of the middle and distal thirds of the radius. Osteoporosis is noted less frequently, but may occur in the tuberosities of the radius or tibia. Specific bone changes were found in 48 per cent of twenty-seven children without clinical manifestation of syphilis, whose parents were syphilitic.

H. C. OCHSNER, M.D.

TUBERCULOSIS (DIAGNOSIS)

Use of X-rays in the Detection of Latent Tuberculosis and Primary Lesions among Children Belonging to a Rural District. Raffaele Paolucci and Aristide Busi. *Bull. Union Internat. Tuberc.*, 1930, VII, 2-49. Abstracted in *Zentralbl. f. d. ges. Radiol.*, Sept. 19, 1930, IX, 271.

In a small Italian town with a known high incidence of tuberculosis, 300 children of the

two lower grades in school were examined for primary infection and latent tuberculosis without symptoms. Thirty-five tuberculin positive and 26 weakly positive children were found—a total of 12.5 per cent. The authors point out the unreliability of the usual clinical signs in these cases. They warn against placing too much emphasis upon the roentgen findings and also stress the occasional failure of agreement between roentgen and autopsy findings. They give the technic of examination and discuss the variety of hilum shadow outlines which are seen. There are illustrations of the primary complex as described by Ranke, perifocal inflammation, and pleural changes. One case in particular is discussed in which there were clinical symptoms of activity, but roentgen examination was negative. Of the 300 children, there were definite roentgenologically demonstrable changes in 6.5 per cent, and 4.1 per cent were suspicious. The result was, therefore, 12.5 per cent had positive clinical evidence (tuberculin reaction), and 10.6 per cent had positive roentgen findings.

H. C. OCHSNER, M.D.

Further Observations on Tuberculosis of the Scapula. Ettore Ponzi. *Chir. Org. Movim.*, 1930, XIV, 664-670. Abstracted in *Zentralbl. f. d. ges. Radiol.*, Dec. 12, 1930, IX, 596.

This treats of a rare condition, only one case having been found in 50,000 examinations at the University of Parma. This patient had a tuberculous spondylitis of the ninth and tenth dorsal vertebrae, with bilateral abscess formation. There was an extensive osteoporosis of the bones of the left shoulder. In the neck and lateral walls of the scapula could be discerned a few trabeculae, but the remainder of the scapula consisted of a homogeneous tissue without trabeculation. The medial margin was notched like a saw, and there was a band-like condensation of its structure. The differential diagnosis between osteomyelitis, acquired syphilis, actinomycosis, and Paget's disease was chiefly on a clinical basis.

H. C. OCHSNER, M.D.

The Diagnosis of Tuberculosis of the Spine. Norman Capener. *Jour. Michigan St. Med. Soc.*, June, 1931, XXX, 431-434.

If possible, the diagnosis of Pott's disease must be made before destruction of bone has occurred and before the formation of abscesses. It is better to err on the side of over-roentgenography than to miss early tuberculous cases. The earliest roentgenographic change is a narrowed and irregular joint space due to destruction of intervertebral disc. This is followed by destruction of the neighboring vertebral bodies, evidenced by osteoclasia on the films.

W. W. WATKINS, M.D.

The Radiographic Factor in the Early Diagnosis of Pulmonary Tuberculosis. Chester A. Stayton. *Jour. Indiana St. Med. Assn.*, Feb. 15, 1931, XXIV, 85-87.

The author discusses the now recognized indispensability of X-ray examination in early diagnosis of tuberculosis, drawing the following conclusions: Chronic lung and pleural pathology can be estimated accurately by X-ray examination, though differentiation requires history and physical and laboratory findings. Tuberculosis of the lungs will often be shown by X-ray before clinical signs and symptoms are present. The adult patient with normal X-ray findings should not be diagnosed as tuberculous without two positive sputums. X-ray interpretation should be independent of the clinical examination, it being classed as positive, normal, or doubtful. With doubtful findings, the clinical study should be more intensive.

W. W. WATKINS, M.D.

Periodical Radiological Examinations as an Aid in the Prevention of Tuberculosis. Wiewiorowski and Bödecker. *Fortschr. a. d. Geb. d. Röntgenstr.*, June, 1931, XLIII, 679-702.

Radiologic examinations should be made periodically in the following:

1. In groups of persons who come into close contact with each other daily, or who are compelled to live together. New admissions to the group should not be permitted until radiologic screen and film examinations have been made to insure that such persons are not tuberculous.

2. If this has not already been carried out, a routine examination of the whole group (*i.e.*, soldiers and police living in barracks, students, school children, teachers, etc.) should be instigated.

3. Persons with active tuberculosis, and particularly those who may be responsible for the dissemination of bacilli, should be excluded from the group and subjected to treatment. Persons with latent tuberculosis should undergo repeated routine examinations, under radiologic control, during their further periods of service.

4. In order to eliminate the presence of a bacillus carrier with active tuberculosis, the radiologic investigations should be repeated at intervals of one or two years.

5. In occupational groups, where liability to tuberculosis is particularly great, or the danger of infection greater than normal, workers with inactive tuberculosis should, on principle, be excluded. In such cases one should try to find the original source of infection. Those already admitted to such occupations, who are suffering from inactive tuberculosis, need be excluded from their employment only if the disease should become active. In such cases, transfer to a more suitable occupation would become necessary.

6. The question as to whether or not an endogenous reinfection or an exogenous reinfection plays the greater rôle in the spread of tuberculosis, is still undetermined. The decrease of the incidence of tuberculosis in the Bremen police force since 1929 (when radiologic inspection was inaugurated), shows that exogenous reinfection can be of great importance.

7. Observation and control of persons whose lungs are not free of suspicion and who engage in strenuous activities, sports, etc., also merit consideration.

HANS A. JARRE, M.D.

Early Diagnosis in Pulmonary Tuberculosis. H. C. Herrmann. *Kentucky Med. Jour.*, August, 1931, XXIX, 393, 394.

Roentgenologically the primary focus of infection should manifest itself as an infiltrative process, but the majority of cases shows reinfection foci with perifocal infiltration, which may appear in any part of the lung. The amount of inflammatory change appearing as an allergic reaction depends on the patient's degree of immunity.

W. W. WATKINS, M.D.

Diagnosis and Treatment of Pulmonary Tuberculosis in Childhood. Daniel Budson. *Jour. Michigan St. Med. Soc.*, January, 1931, XXX, 19-22.

The X-ray is by far the most important diagnostic agent in the early diagnosis of tuberculosis in infancy. Upon it often lies the entire burden of proof of the disease.

The diagnosis of tuberculosis in childhood rests on four points: first, a history of exposure; second, the tuberculin reaction; third, the examination of sputum, best obtained by stomach lavage; fourth, and most important, the X-ray examination. Symptoms and physical signs are of little value, and the only positive proof, aside from a positive sputum, is the X-ray evidence.

W. W. WATKINS, M.D.

Diagnostic Inaccuracy in Tuberculosis of Bone, Joint, and Bursa. Joseph E. Milgram. *Jour. Am. Med. Assn.*, July 25, 1931, XCVII, 232-235.

A group of definitely tuberculous cases was studied to find how many were incorrectly diagnosed clinically and what factors entered into the misdiagnosis. In 142 cases analyzed, 61.3 per cent were diagnosed clinically as tuberculosis. Of the factors concerned, observations sustained the onset as insidious, the average duration of all lesions to pathologic verification being 3.1 years. In 29.5 per cent the onset was sudden, and in these 61.9 per cent were incorrectly diagnosed.

Obviously, the insistence on a gradual onset

in the clinical picture of tuberculosis of the joints is most unhappy. As to the relation of trauma, nothing definite could be adjudged save that the appearance of symptoms after an unusually severe injury followed by prolonged incapacity was a frequent observation. The insistence on mild pain in "closed tuberculosis" is not justified by this study.

The monarticular or local character of surgical tuberculosis appears to be overstressed. In the author's series 32.7 per cent presented two or more lesions.

Roentgen examination, while usually helpful, was often the reverse. In 53 cases, such examination was of no aid or was misleading. In general, the roentgenogram reflected in atrophy or destruction the common pathologic changes of tuberculosis of tissue but could be interpreted to suit a wrong diagnosis. Particularly was this the case when an unusual tissue reaction, such as bone formation, had taken place. A review of the plates in the light of the pathologic observations was often not illuminating.

Of all the simple diagnostic aids, a carefully controlled and repeated intradermal tuberculin test, if negative, is of greatest value in excluding tuberculosis. Pathologists err, recognition of tuberculous tissue grossly is difficult, and errors may be made even in microscopic sections, the isolation of the organism being the only conclusive evidence.

C. G. SUTHERLAND, M.B. (Tor.)

TUBERCULOSIS (THERAPY)

The Treatment of Tuberculous Diseases of the Eye and Its Surroundings by Roentgen and Radium Rays. Hoffmann. *Deutsche med. Wchnschr.*, 1931, LVII, 1448.

The author reviews briefly the literature concerning roentgen and radium therapy in infections of the eye. In his own clinic, radium is given the preference.

The radium applicator consists of a rectangular brass screen 1 mm. thick, holding 15 small platinum tubes of 0.2 mm. wall thick-

ness, containing 2 mg. radium element. At 1 cm. distance, 360 mg.-hrs. produce an erythema. As a rule, 72 mg.-hrs. are applied to the eye in three days. If necessary, in from two to three weeks later another treatment may be given.

After analyzing the results, the author concludes that tuberculous disease of the lacrimal duct and glands and of the conjunctiva are most suitable for radium therapy. In dacryocystitis, the rehabilitation of the function may be possible; in tuberculosis of the conjunctiva, the scars are of little disturbance. In these cases radium therapy should be tried first. In the diseases of the eye ball, only stubborn cases of episcleritis and scleritis are amenable to radium therapy. In inflammations of the uvea, the productive type may respond to radium, while the chronic types can be benefited only if the patient can be treated for several months.

Since not many cases have been published and our experience in this field is rather limited, no definite directions concerning the technic can be given. Each individual case has to be treated very cautiously on its own merits.

ERNST A. POHLE, M.D., Ph.D.

The Influence of the Sea Climate on Bone and Joint Tuberculosis. H. Klose. Strahlentherapie, May 20, 1931, XL, 624-636.

The author outlines the great importance of the sea climate in the treatment of surgical tuberculosis, based on observations made along the shores of the German East and North Seas.

ERNST A. POHLE, M.D., Ph.D.

Treatment of Verrucous Tuberculosis by Radiotherapy. Jean Gaté, Jules Coste, and P. Michel. Urol. and Cutan. Rev., July, 1931, XXXV, 426-429.

The authors review the literature and discuss the various methods that have been employed in the treatment of verrucous tuberculosis. They have used radiotherapy in fifty cases of this type with excellent results. However, their results in the treatment of lupus

were not very encouraging. The technic employed was as follows: (1) Absence of all curettage of the lesions; (2) single irradiation (in cases in which the diseased surface had a dimension larger than from 25 to 30 centimeters square, the irradiation was divided into two or more fields); (3) absence of all filtration, and (4) utilization of a penetrating radiation of medium wave length.

Two cases are reported in which successful treatment was obtained by the use of radiotherapy. The first case was that of a girl, 22 years of age, who presented a verrucous tuberculosis of the left leg, of four years' duration. A dose of 4,500 r was given at an anticathode-skin distance of 26 centimeters, intensity of 2 mm. tension corresponding to 16 cm. E. E. between points, duration of irradiation, 45 minutes per field. Cicatrization was prolonged on account of the lesions being very deep and situated in a region unfavorable to reparation, but the patient left the service in excellent health from every point of view.

The second case was that of a man, 47 years of age, with a verrucous tuberculosis of the right hand and forearm, of five years' duration. The fingers were tumefied and knotted and covered with large suppurating verrucous zones encroaching upon the forearm, where there was a veritable tuberculous gumma. Roentgenotherapy was instituted immediately and different sectors were irradiated separately and successively at intervals of several weeks. Cicatrization of each sector occurred in from six to nine weeks.

J. N. ANÉ, M.D.

Heliotherapy in Tuberculosis of the Lungs. Hellmuth Deist. Strahlentherapie, May 20, 1931, XL, 658-665.

Heliotherapy of tuberculosis of the lungs is a non-specific stimulative treatment. When using heliotherapy, one must not forget that tuberculosis is a systemic disease. Patients with surgical tuberculosis usually also have an affection of the lungs, which limits the efficacy of heliotherapy in surgical tuberculosis. Not all cases with active lung tuberculosis are suit-

able for heliotherapy. It is necessary, therefore, to arrive at a correct diagnosis before starting light treatment. Tuberculosis in childhood is treated along the same lines as in adults.

ERNST A. POHLE, M.D., Ph.D.

Scalenotomy in the Surgical Treatment of Pulmonary Tuberculosis. Joseph W. Gale and William S. Middleton. *Arch. Surg.*, July, 1931, XXIII, 38-46.

Phrenic block has an established place in surgical treatment for pulmonary tuberculosis, regardless of location. The increased respiratory activity of the upper part of the thorax after paralysis of the diaphragm raises the question as to the physiologic soundness of the operation in apical lesions. From experimental and clinical studies, the scaleni have been proved to have an important relation to the respiratory activity of the upper part of the thorax.

In a series of cases of pulmonary tuberculosis scalenotomy has induced satisfactory immobilization of the involved apex. The authors believe that combined scalenotomy and phrenic block apparently answer the need for some surgical measure to induce apical rest coincident with paralysis of the diaphragm. When a phrenic block has not effected the desired improvement, scalenotomy may be performed as an adjunct of a conservative type at a later period before resorting to a radical measure, or both of these procedures may be done at the same time.

HOWARD P. DOUB, M.D.

Progress in the Management of Tuberculosis. O. M. Gilbert. *Kansas City Southwest Clin. Soc. Monthly Bull.*, July, 1931, VII, 14-20.

The author emphasizes the importance of the recognition of tuberculosis at a time when it is still curable. While few diseases offer as unfavorable a prognosis as far-advanced and progressive tuberculosis, not many offer a better prospect for restoration of the individual to normal life if the disease

is recognized and proper measures are taken when the involvement is minimal.

There has been considerable discussion as to whether the clinical tuberculosis, which occurs in later life, is most commonly due to a spread of a previous childhood infection or to a reinfection from without. While it is believed that in the majority of cases the disease results from a spread of one's own previously latent infection, it should be remembered that the immunity conferred by previous infection is only relative and not absolute. In this manner, the frequency of marital infection, as shown by Opie and McPhedran, may be explained. The author is of the opinion that as much attention should be given the carrier of tuberculosis as that of diphtheria or typhoid fever, for he believes that the bulk of the infection is now being spread by the unrecognized case.

The first, and in many instances the most important, procedure in the recognition of tuberculosis is good history-taking, with a proper evaluation of the facts elicited. A history of prolonged and intimate association, especially in early life, with one having an active infection is of the utmost importance. The symptoms which should lead to a suspicion of the presence of tuberculosis are: Loss of weight, fever, undue tiring, obstinate colds, hemoptysis, pleurisy (particularly with effusion), cough lasting more than a month, hoarseness, vague indigestion, amenorrhea, rectal abscess, or night sweats.

Lawrason Brown's criteria, one or more of which must be present to establish a diagnosis, are: Hemoptysis, pleurisy with effusion, persistent medium coarse râles, tubercle bacilli in the sputum, and roentgen-ray demonstration of a parenchymatous lesion. It is believed by the author that a well-taken and well-interpreted stereoscopic X-ray examination is the most valuable single aid to diagnosis. It is important, however, to correlate the X-ray evidence with the clinical findings.

In the treatment of tuberculosis the fundamental principles to be observed are rest, fresh air, and good food. Almost all patients show more progress for having had a preliminary training in a sanatorium or nursing home be-

fore home treatment is instituted. The degree of rest required depends upon the activity of the case. In some of the more severe and more progressive types, even without laryngeal involvement, the patient should be forbidden to talk or even whisper for a few months. Webb and Forster have suggested having the patient lie almost wholly on the more active side, thereby to a degree splinting the involved lung. Artificial pneumothorax, phrenectomy, and thoracoplasty are methods which, likewise, have proven valuable procedures in obtaining rest for the involved lung.

The author believes that climate is of secondary importance, and that it is far better to have the patient in the worst climate doing the right thing than in the best climate doing the wrong thing.

J. N. ANÉ, M.D.

The Limitations of the Climatic Treatment of Bone and Joint Tuberculosis. H. Denks. *Strahlentherapie*, May 20, 1931, XL, 645.

The beneficial influence of the sea climate on surgical tuberculosis cannot be denied. However, not all cases respond to it equally well, notably patients with chronic osteomyelitis and amyloid degeneration being in this group. A few case histories illustrate the author's experiences.

ERNST A. POHLE, M.D., Ph.D.

Renal Tuberculosis. John R. Caulk. *Jour. Urol.*, August, 1931, XXVI, 189-204.

The author finds that renal tuberculosis is declining in frequency as a result of the improvement in the early diagnosis and treatment of pulmonary and general tuberculosis, with its accompanying prevention of massive lesion. An early diagnosis in renal tuberculosis is of paramount importance. The cystoscopic picture is most significant. In unilateral renal tuberculosis, nephrectomy should be performed at once. Surgery in bilateral renal tuberculosis is indicated only in cases of emergency to relieve toxemia from pyonephrosis or to correct intractable vesical lesions.

The immediate relief of symptoms in many of the cases after nephrectomy is due to the

removal of a tuberculin reaction created by the products of bacteria, dead and alive, tuberculo-proteins, fats, and fatty acids. Ofttimes the more acute the lesion in the bladder, the more quick the healing and relief of symptoms following the removal of the diseased kidney.

The relief of bladder symptoms may be expected in at least 75 per cent of the cases of unilateral renal disease, instead of an almost positive assignment to invalidism, if left to medical care.

The chance of healing in chronic renal surgical tuberculosis is remote and not comparable to the simple early experimental lesions. The mortality of nephrectomy is exceedingly low. The X-ray may be helpful in diagnosis. The presence of calcification in the kidney region or complete calcification of the kidneys will occur in a certain percentage of cases. In the author's series the number has been less than 10 per cent.

Urography has an important place in the diagnosis. The author used it on almost every patient with renal tuberculosis and has yet to see any trouble resulting from it. In many instances it gives no information. It, however, fortifies the examination in a great many cases and in a few may give the only positive evidence of the disease. The fuzzy, fringed localized lesion in the region of a calyx is very significant. The ureteral or pelvic impression is often characteristic and very helpful in the final summing up of the case, and while this procedure is not absolutely essential, in most cases, if properly executed, it adds to the precision of the diagnosis without unnecessary hazard to the patient.

DAVIS H. PARDOLL, M.D.

Artificial Pneumothorax in Pulmonary Tuberculosis. W. C. Sharpe. *Can. Med. Assn. Jour.*, July, 1931, XXV, 54-57.

The person in whom the tuberculous lesion in the chest is in the early stages and not very extensive will in many cases overcome the disease by rest alone. In some, however, the resistance is poor, and the lesion continues to be progressive, or the lesion was well advanced when treatment began, and bed rest alone is not sufficient. The problem of treat-

ment then becomes more complicated. Some form of localized rest to the diseased lung becomes necessary, in addition, or the patient will fail to make recovery. Immobilization of the diseased lung is best accomplished by some form of lung collapse. The measures most commonly used in producing this collapse are: Artificial pneumothorax, phrenicectomy, or thoracoplasty. Of these, the most widely used is artificial pneumothorax.

Where formerly the patient was placed in bed and kept there for months and years, and the pneumothorax was induced only as a last resort, now the measure is used much earlier in the treatment. As soon as it is felt that the patient will be unable to overcome the disease on bed rest alone, pneumothorax is considered.

The lung collapse obtained by pneumothorax alters the circulation of the blood in the treated lung, with slowing of venous flow and lymph stasis, and with less absorption of toxin. Cavities become gradually closed and their walls approximated; the purulent discharges decrease; resolution is promoted, and fibrosis of the lesion stimulated, with the end-result of scar formation in place of an active lesion. Accompanying clinical changes are: Lowering of temperature; lessening of cough and expectoration; expectoration of tubercle bacilli and blood stopped. The general health improves.

Contra-indications to the measure are: The presence of an active lesion in the other lung; advanced laryngeal involvement; extensive ulceration of the bowel; a bilateral tuberculous kidney condition, or a decompensating heart.

The patients who do best on artificial pneumothorax are as follows:

(1) Those in whom the lesion is fairly early, active in one lung only, and who show no apparent improvement under ordinary bed rest.

(2) Those in whom there is extensive tuberculosis in one lung with widespread caseation and probably cavitation.

(3) Those with unilateral pneumonic phthisis. Prompt action is necessary.

(4) Those with a cavity of 2 cm. or over, in whom the lesion is unilateral, or in whom there is copious sputum loaded with bacilli.

(5) Those in whom there is a moderately advanced lesion on the better side, but in whom the better lung has shown, under rest, considerable healing and fibrosis, while the lesion in the worse lung has slowly progressed.

(6) Those in whom there is complication by uncontrollable hemorrhage, if the side from which the hemorrhage is coming can be determined.

Every case which is scheduled for artificial pneumothorax should receive careful clinical and X-ray examination before the procedure is decided upon. They should be fluoroscoped before and after to determine the amount and location of collapse, the position of the heart and mediastinum, and to note the presence of any fluid in the pneumothorax pocket. The number and degree of treatments should be regulated by periodic physical and X-ray examinations. During the first two months the patient should be kept absolutely in bed, and in the sanatorium for a period of six months.

Pneumothorax treatments should be kept up for a minimal period of two years in early cases and, in cases in which there is cavity formation, close to five years, depending on the length of time it took to collapse the cavity.

L. J. CARTER, M.D.

TUMORS (DIAGNOSIS)

Massive Pulmonary Sarcoma Secondary to an Osteosarcoma of the Rib in a Child Eight Years Old. M. Serfaty and Oscar R. Marottoli. *Prensa Méd. Argentina*, July 30, 1931, XVIII, 259-267.

A child eight years old was admitted with the following history: Four months previously she started complaining of pain in the left chest, accompanied by a general feeling of malaise, lack of appetite, fever, and chills. Two and a half months later, a tumefaction was noticed at the site of the pain. This grew gradually. Examination revealed the mass attached to the ninth rib. A radiograph showed destruction of the ninth rib at the site of the tumor-mass. At biopsy a round-cell sarcoma was found. The tumor was removed *en bloc* and X-ray treatment applied. The

patient was dismissed from the hospital, but fourteen months later she returned in a bad general condition. Both clinically and radiologically, she was found to have a tumor-mass involving both lungs, this being confirmed at autopsy.

N. G. GONZALEZ, M.D.

Kidney Tumors in Children. George C. Prather and E. Granville Crabtree. *Jour. Urol.*, June, 1931, XXV, 589-612.

The authors have reviewed the literature on this subject very carefully and found over 100 cases of kidney tumors in children reported since 1924. They describe in detail four cases of their own. In this series of collected cases, 46.1 per cent were males, and 53.9 per cent females. The average age incidence was 2.7 years. The tumor distribution was approximately equal between the right and left kidney. The initial lesion was found to be as follows: Palpable mass in 80.1 per cent; hematuria in 14.5 per cent, and pain in 5.4 per cent. Frequently, at cystoscopy, very little urine was obtained from the affected kidney, with a correspondingly low or absent function.

In considering the treatment, surgery was found to offer the only hope for relief at the present time. Radiation did not seem to help this particular type of tumor.

The prognosis is rather poor, only 12.3 per cent living two years or longer following surgery.

DAVIS H. PARDOLL, M.D.

Chancre or Epithelioma of the Upper Lip? A Contribution to Differential Diagnosis. Herbert Colman. *Urol. and Cutan. Rev.*, August, 1931, XXXV, 509, 510.

The author reports the case of a man, 43 years of age, who presented on examination a tumor the size of a shelled hazelnut, which was dark red, moderately hard, almost painless, and surrounded by a small, infiltrated border. The surface was covered by a scab, which the patient scratched off several times a day. While there was no history of a syphilitic infection and dark-field examinations of

scrapings from the lesion were negative, the Wassermann reaction was found to be positive. Physical examination revealed syphilitic changes of the heart and vessels.

As a result of specific syphilitic therapy, prompt recession of the lesion occurred to a certain point, when all healing ceased. When biopsy was refused, the lesion was treated with very hard roentgen rays, and in three weeks the tumor completely disappeared.

J. N. ANÉ, M.D.

A Rare Type of Lymphogranulomatosis of the Mediastinum: A Contribution to the Differential Diagnosis of Mediastinal Tumors. Aloys Auer. *Röntgenpraxis*, Sept. 1, 1931, III, 799-801.

A large, well-defined homogeneous shadow—suggestive of a dermoid cyst—was seen roentgenologically in the right mediastinum in a twenty-seven-year-old woman. A tumor, the size of a child's head, was removed surgically and proved to be a lymphogranulomatous mass, containing several large cavities. A similar appearance of Hodgkin's disease could not be found by the author in the literature.

H. W. HEFKE, M.D.

Reticulo-sarcoma of the Inferior Maxilla. Robert Dupont, P. Foulon, and Y. Dupont. *Bull. de l'assn. franç. p. l'étude du cancer*, May, 1931, XX, 323-329.

The authors report the case of a patient, 17 years of age, who presented a tumor of the inferior maxilla, following a traumatism received in that region two months previously. The mass involved the medial portion of the mandible and extended backward to the sublingual region. An X-ray examination at this time showed marked bone destruction, but the appearance of the lesion was not that of the more commonly observed types of sarcoma.

Immediately after the injury, some swelling and ecchymosis were noted by the attending physician, but there was no evidence of fracture of the mandible or of a superficial wound in the traumatized region. The swelling

gradually increased in size, and a biopsy was performed. After traversing the superficial planes, a softened tissue was noted which was not limited by either a fibrous or bony capsule. The wound healed subsequently by first intention. Histologic examination of the removed specimen revealed characteristics of a malignant tumor, apparently of hematopoietic origin. The exact type of the growth was not determined.

While the tumor was of a very hard consistency in the sub-maxillary area, it was much softer, even fluctuant, in the lateral regions. In the left posterior extremity the mass terminated in a clearly defined projection which gave the impression of a bony process. On examination of the mouth the gingivobuccal ridge was found completely infiltrated. Because of the encroachment into the mouth considerable difficulty was experienced by the patient in deglutition and mastication.

Except for the involvement of the inferior maxilla, the general examination was negative and the general condition of the patient was excellent. There existed no adenopathy or splenomegaly. The blood count was normal. An X-ray examination at this time revealed a very extensive lesion of the mandible. The entire anterior portion was destroyed and small bony trabeculae were noted, which formed a very delicate network. Histologic examination after a second biopsy revealed a typical reticulo-sarcoma. Much syncytial tissue was observed, with rounded and slightly oblong nuclei, with numerous mitotic figures.

The patient was subsequently treated by radiotherapy. In a period of approximately one month a total of 12,000 r was given over three fields, with a filtration of 2 mm. copper plus 2 mm. aluminum, at a focal skin distance of 50 cm., 200 K.V., with an intensity of 3.5 milliamperes. Following this treatment there resulted a progressive decrease in size of the mass, and the gums and lips regained their normal aspect.

The authors consider the reaction of this tumor to radiotherapy as conforming to the general rule, for it is known to be radio sensitive.

J. N. ANÉ, M.D.

Chorionepithelioma in the Male. Julian Arendt. *Fortschr. a. d. Geb. d. Röntgenstr.*, June, 1931, XLIII, 728-735.

This is a case report concerning a male, aged 20, who, during his entire youth, was regarded as physically and emotionally somewhat abnormal and died of a chorionepithelioma of the mediastinum, with extensive pulmonary metastasis.

These tumors are theoretically of great interest, and a short discussion of some of their features is given.

HANS A. JARRE, M.D.

Arterial Encephalography and Its Value in the Diagnosis of Brain Tumors. Egas Moniz, Amandio Pinto, and Almeida Lima. *Surg., Gynec. and Obst.*, August, 1931, LXIII, 155-168.

The authors state that they have been quite uniformly successful in localizing brain tumors by injecting into the internal carotids a liquid opaque to X-ray. By this method the arterial system of the brain is shown. The contra-indications are sclerosis of the brain arteries and repeated examinations.

The patient is given 30 centigrams of luminal the night before and the morning of examination. Local anesthesia is used, although general anesthesia is not contra-indicated. The patient is put in the classic position required for ligature of the carotids, and skin incision is made. Preferably, the internal carotid is injected but when the bifurcation of the common carotid is higher than usual, the injection is made into the common carotid, temporarily obliterating the external carotid. From 6 to 7 c.c. of a 22 to 25 per cent solution of chemically pure, recently prepared, watery solution of sodium iodide is used. The patient is placed so that the head is horizontal, with the side to be injected towards the tube, and the head is held in a fixed position by means of bandage. When the patient is properly placed and the X-ray apparatus is ready to use, the injection is quickly given and the roentgenogram made immediately when the solution has entirely entered the artery. If the film does not sufficiently reveal the arteries, the injection is re-

peated. The wound is closed in the usual way and leaves little scar. The authors state that they have examined approximately 100 patients by this method and have experienced no difficulties.

Interpretation of the films is by visualization of the accessory circulation of tumors or dislocation of the arteries.

This article is well illustrated by arteriograms and numerous case histories. Particular attention is paid to the visualization of the sylvian group, and the method is particularly adaptable to tumors of the central regions which offer very deficient clinical symptomatology.

DONALD S. CHILDS, M.D.

A Case of Primary Synchronous Duplicity of Malignant Tumor: Cancroid of Nasal Ala with Papilocarcinoma of Larynx. Zdeněk Kočka. *Otolaryngol. Slav.*, April, 1931, III, 233-245.

While secondary metastatic carcinomatous tissue is commonly found in locations other than the primary seat of carcinoma, it is considered extremely rare to find two or more independent primary carcinomas in the same patient. It is sometimes difficult to differentiate between a metastatic lesion and an independent carcinoma. Billroth and Goetze have independently formulated postulates to establish primary multiplicity. These, however, are not sufficient when applied generally, and Siebke and Šikl are of the opinion that each case must be studied on its own merits. Virchow concluded that metastases were rarely found in organs with a predilection for the formation of primary tumors. He also suggested that the question of multiplex primary carcinomas should be eliminated in those organs in which primary carcinomas never occur. There is but little probability of their occurrence in the organs with a predilection for metastases.

The author reports the case of a man, 52 years of age, who complained of a husky voice of eight months' duration. This was accompanied by pain in swallowing and some difficulty in breathing. He also presented a painless ulcer of three years' duration in the naso-

facial groove, at the ala of the nose. The cancroid on the left nasal ala proved, on further study, to be a basocellular carcinoma. A spinocellular carcinoma was found to involve the laryngeal region. The cancroid retained the structure of an adenoma, was comparatively benign, and its metastases were not proved. The laryngeal tumor arose from a papilloma of the larynx and its malignancy exceeded that of the cancroid. The tumor at the ala of the nose was believed the older.

It was decided to administer radium emanation therapy to the patient because of the extent of the laryngeal involvement. Irradiation was applied externally by means of ray-emitters enclosed in a wooden block, placed so that the ray-emitters were 4 cm. distant from the skin surface. The total dose of 21 mcd. (millicuries destroyed) was administered at a single sitting and left to act one week. To the cancroid on the ala of the nose, Dominici's tube, containing radium salt with 8 mc., was applied for five days. The total dose amounted to 5 millicuries destroyed. The radium therapy was still in progress at the time the author made this case report.

J. N. ANÉ, M.D.

Mediastinal Tumors. D. Y. Keith. *Kentucky Med. Jour.*, August, 1931, XXIX, 396-399.

About 50 per cent of mediastinal new-growths are primary, from 80 to 85 per cent of them being sarcoma or lymphosarcoma. Primary lymphosarcomas are most frequent between the ages of 30 and 50. The size of the tumor is no index to the severity of the symptoms. Although radiation is usually only palliative, it is the only available treatment.

W. W. WATKINS, M.D.

Extra-pleural Fibroma of the Posterior Mediastinum: Diagnostic Study. René Huguénin and Guy Albot. *Bull. de l'assn. franç. p. l'étude du cancer*, May, 1931, XX, 330-342.

The authors discuss the importance of employing every method of investigation in the study and diagnosis of tumors of the lung and

posterior mediastinum. They report a case which demonstrates the successive stages which are frequently necessary before a diagnosis can be established.

The patient, a man, 48 years of age, experienced attacks of tachycardia and inspiratory dyspnea accompanied by a sensation of anguish and precordial constriction. These attacks became so violent that he was forced to remain absolutely quiet during these periods. He also had severe coughing spells, sometimes followed by the vomiting of a large amount of mucoid, milky, and odorless expectoration. He did not experience any digestive disorder, dysphagia, or changes in his voice. While this syndrome had had its beginning three years previously, it gradually became more and more severe until he was forced to rest sitting in bed. He complained, likewise, of a pain in his left arm. With these clinical findings one would be very much tempted to consider anginoid crises with cardiac failure, especially when physical examination revealed an enlarged heart and a double blow over the aortic area, which was transmitted over the entire precordium. Although treatment was directed for a cardiovascular condition, the patient showed very little change.

Fluoroscopic examination at this time revealed an oval regular opacity, with the long axis directed vertically, situated in the inner portion of the right pulmonary field and almost in the median line. This shadow was observed to move with the cardiac impulse, but not with pulmonary expansion. The diagnosis of aneurysm was eliminated, because roentgenograms revealed the cardiac and aortic shadows to be situated more to the anterior and to be of lesser density than the shadow of the mass. Likewise, pulmonary tuberculosis and a cold abscess of the vertebræ or ribs were ruled out because of the radiologic aspect. Lipiodol was subsequently injected into the bronchi, and it was noted that they filled completely with no evidence of obstruction. It was also determined that the mass was located posterior to the bronchial tree. This procedure eliminated the possibility of a tumor of the lung, a tumor of the posterior mediastinum remaining the most probable diagnosis.

The opacity of the mass and the regularity in outline suggested a glioma or a fibroma.

Assuming that a glioma was present, the patient was treated by radiotherapy, receiving 24,000 r through three ports of entry. A filter of 2 mm. of copper plus 2 mm. of aluminum was used. This treatment seemed to relieve the patient somewhat, but the size of the mass was not affected. It was accordingly considered to be a fibroma located in the posterior mediastinum. Before surgical intervention could be attempted, however, a severe cardiac attack, pulmonary edema, and death followed.

Postmortem examination revealed a large, dilated heart. The tumor mass was found isolated from the lung and extra-pleural but attached to the right side of the vertebral column. Macroscopic and histologic examination of the tumor revealed the characteristics of a fibroma.

J. N. ANÉ, M.D.

TUMORS (THERAPY)

The Treatment of Cutaneous Epitheliomas. Maisin. Bruxelles-Méd., May 24, 1931, XI, 891.

The author discusses the various treatments and gives preference to the association of coagulation and radium which should be preferred to surgery and cauterization. He condemns cauterization altogether. Surgery is followed by a considerable percentage of recurrences.

HENRY BAYON, M.D.

The Present Status of Roentgen Therapy of Tumors. A. Voegeli. Schweiz. med. Wchnschr., Dec. 27, 1930, LX, 1226-1232.

The experience of radiotherapists in recent years has appreciably advanced knowledge of the general biologic principles underlying the irradiation of malignant tumors. The most important of these are as follows: (1) Maximal intensity of radiation must be secured; (2) best results are obtained by the use of rays generated at 180:200 P.K.V. and filtered through 0.5 to 0.7 mm. Zn; (3) irradiation

must be limited to the diseased part. The surrounding normal tissue must be avoided so far as is possible; (4) the topographic location of the involved area should be accurately known; (5) there are three methods of irradiation: (a) application of the lethal dose for carcinoma in one dose (Wintz); (b) saturation method (Pfahler-Holfelder); (c) the prolonged fractional method of Regaud and Coutard.

The author discusses localization of tumors, general therapeutic technic, apparatus, and dosimetry. He describes methods of irradiation for the various tumor types.

H. C. OCHSNER, M.D.

Lentigo Maligna: Report of One Case Treated with Radium. Henry C. Shaw. *Am. Jour. Cancer*, July, 1931, XV, 1557-1569.

The author reviews the literature and calls attention to the rarity of the lesion. There have been 103 cases of true cutaneous melanomas in 46,000 consecutive admissions to the Barnard Free Skin and Cancer Hospital since 1905, for treatment of all forms of skin disease and cancer. Of the 103 cases, only one could be classified as lentigo malignum.

A case of lentigo malignum is reported, with histologic study. A complete and apparently permanent retrogression of every epithelioma treated with radium was noted. According to Shaw, radium should be considered in the treatment of lentigo malignum.

JOHN R. CARTY, M.D.

On the Absence of Elective Fixation of Bismuth in Cancerous Tumors. A. Lacasagne and J. Loiseleur. *Compt. rend. Soc. de biol.*, June 5, 1931, CVII, 462-464.

The attention of the authors was attracted by publications of Hevesy and Wagner, who found that 42 hours after a subcutaneous injection of 0.25 mg. of bismuth in mice, the quantity retained in the tumor was eighteen times larger than that retained in the healthy tissues.

The authors also compare their findings with the experiments of Kahn, who, after in-

jecting bismuth in combination with radium E, evaluates the affinity of bismuth for the principal organs by the proportion of radium measured by the radio-activity of their ashes. Kahn reports that one week after the injection the total bismuth retained in the normal tissues is but one-third or one-fifth of that found in the tumor.

The authors employ the same method and obtain opposite results. The radium E injected in spontaneous mammary epitheliomas of mice was retained in the kidneys, liver, and spleen in much larger quantities than in the tumor. From these findings, the quantity of bismuth was determined and proved to have been much smaller in the cancer mass than in the organs, such as the liver and kidneys.

HENRY BAYON, M.D.

ULCERS (ETIOLOGY)

The Association of Peptic Ulcer and Cholecystic Disease. Andrew B. Rivers and James B. Mason. *Minn. Med.*, April, 1931, XIV, 330-335.

The authors refer to the report of H. R. Hartman and A. B. Rivers (*Arch. Int. Med.*, September, 1929, XLIV, 314-338) on the lesions found in 700 patients clinically diagnosed as duodenal ulcer, and also to the report on an investigation made by them with regard to the percentage of lesions associated with the different types of operable conditions in the upper right quadrant. The material consisted of 2,161 operative records, of which 700 were duodenal ulcer, 435, gastric ulcer, and 1,026, cases of cholecystic disease. Cholecystic disease was found in 13.6 per cent of the cases of duodenal ulcer and in 7.8 per cent of the cases of gastric ulcer. In the cholecystic cases, only 7.1 per cent showed peptic ulcer. There were 202 cases of combined peptic ulcer and cholecystic disease, and these were studied in detail.

It is often impossible to make a differential diagnosis of peptic ulcer or cholecystitis, and the association of the two conditions presents further difficulties. If patients with symptoms

and X-ray evidence of ulcer fail to obtain relief on the proper diet, it may be assumed that the ulcer is complicated. Cholecystographic examination will be of unquestionable value in studying such cases.

W. W. WATKINS, M.D.

The X-ray Diagnosis of Peptic Ulcer. A. W. Crane. *Jour. Michigan St. Med. Soc.*, July, 1931, XXX, 487-490.

With the aid of the X-ray, checked by surgical exploration, in a few years greater advances in the diagnosis and treatment of gastric and duodenal ulcer have been made than were made in all the centuries preceding the discovery of Roentgen.

Internists and surgeons should be familiar with the evidences of gastric ulcer as shown by X-ray. There are three major signs, any one of which means gastric ulcer: the niche, the accessory pocket, and the hour-glass contraction. The niche is the profile of an ulcer filled with barium. The accessory pocket is formed by the gradual perforation of an ulcer. Organic hour-glass results from cicatricial contraction of an old ulcer.

The X-ray signs of duodenal ulcer are fewer, more decisive, and more easily demonstrated than those of gastric ulcer. They consist of the niche, the incisura, the accessory pocket, the contracture, and the contributory signs of hypermotility and pylorospasm (with six-hour residue).

In practical work, the X-ray examination should include the whole gastro-intestinal tract, not excepting the esophagus. By oral administration of dye, it is possible to include the gall bladder, reserving the intravenous administration for confirmation in doubtful cases.

W. W. WATKINS, M.D.

ULTRA-VIOLET LIGHT

Investigations Concerning the Question of Dosage of Ultra-violet Light. I.—How can One Use the Various Measuring Methods Known in Light Biology and

Therapy for the Determination of the Erythema Effect of Various Radiations? R. du Mesnil de Rochemont and H. Kirchhoff. *Strahlentherapie*, 1931, XLI, 710.

The authors investigated the intensity ratio of two different light sources (quartz mercury vapor lamp and Kander arc) by means of various measuring methods. Their object was to determine how well the results obtained by the various measuring methods run parallel to the skin erythema. It appeared that the intensity ratio of the two lamps as obtained by the cadmium photo-electric cells agrees best with the erythema reaction. If the Bering-Meyer iodine test was used, the erythema effect of the arc lamp was measured too low. This is due to the fact that the iodine test responds to radiation below 2,800 Angströms. If one would use, therefore, the figures obtained by the iodine test, the erythema reaction would be much higher than expected. It was found that one must divide the erythema time determined with the iodine test by 1.7 in order to get the true value. Keller's photographic method gives similar results to the iodine test. His figures hold only for the quartz lamp, being too high for the arc light used by the authors. The use of a uviole glass filter does not remedy these shortcomings.

ERNST A. POHLE, M.D., Ph.D.

Ultra-violet Radiations in Diseases of the Skin. Robert Aitken. *Urol. and Cutan. Rev.*, August, 1931, XXXV, 495-499.

Because of mistakes in diagnosis and lack of knowledge regarding conditions, many extravagant claims have been made for ultra-violet ray treatment in diseases of the skin. While it is sometimes stated that the bactericidal rays are the important ones in the treatment of diseases of the skin, the author believes they are practically useless, for, if the organisms are on the surface, they can be killed easily by ordinary remedies. If they are deep, the short or bactericidal rays cannot reach them as these rays have little or no penetration. The long ultra-violet rays are the valuable ones in dermatology. The author

prefers the carbon arc to the mercury vapor lamp for this type of work because there is more uniformity of output.

Ultra-violet radiations have been of great value in the treatment of tuberculosis of the skin, both in its manifestation as lupus vulgaris and as scrofuloderma. The best results are obtained in the catarrhal type of lupus. The type of tuberculous lesion which is the most resistant to light treatment is the pseudo-elephantiasis type.

While the ultra-violet ray treatment is considered a valuable remedy in many cases, it does not act as a specific in the treatment of alopecia areata. In this condition, the doses to the scalp must be sufficient to produce a reaction but this redness should be allowed to disappear before the treatment is repeated.

Furunculosis in its chronic form responds well to ultra-violet radiations. Sycosis, psoriasis, and lupus erythematosus at times respond favorably to this form of treatment but the results sometimes are very disappointing. In herpes zoster the only value of ultra-violet ray treatment is in the relief of pain, which frequently accompanies this condition.

In acne, in cases in which there is considerable pustulation, the light treatment may clear this up, but it will not cure the disease. The results are not in the least comparable to those obtained with X-ray treatment. In the therapy of ringworm of the scalp, epilation by means of X-ray or thallium offers the only efficient form of treatment. The only value of ultra-violet rays in ringworm of the scalp is in the diagnosis. When a filter of Wood's glass is placed between the source of ultra-violet radiation and the child's head and the room is darkened, the ringworm hairs will fluoresce a brilliant green, while the normal hairs will not. As scabies can usually be cured in three days by other remedies, it is absurd to advise ultra-violet ray treatment for this condition.

J. N. ANÉ, M.D.

Studies on Ultra-violet Transparent Glass. R. Suhrmann and F. Breyer. *Strahlentherapie*, May 20, 1931, XL, 789-795.

The authors came to the conclusion that

changes of the transparency of ultra-violet glass following exposure to the sun and atmosphere are of a photochemical nature. The changes reverse themselves slowly after the glass is placed in the dark. The ultra-violet transparent glass which they used in their experiments transmitted nearly all infra-red rays of the sun, but absorbed, like ordinary window glass, the long heat rays.

ERNST A. POHLE, M.D., Ph.D.

Action of Ultra-violet Rays in Blood Sulphur. M. Loeper, R. Degos, and A. Lesure. *Compt. rend. Soc. de biol.*, March 13, 1931, CVI, 718, 719.

This is a study of the effect of ultra-violet radiation on the metabolism of sulphur. The blood sulphur was first determined before irradiation, then ten minutes, one hour, and two hours later, respectively. The dosage of sulphur was given in total sulphur, oxydized sulphur, and neutral sulphur.

The total sulphur was always lowered after ten minutes' irradiation and continued to diminish over one hour and remained low for ten days. The oxydized and neutral sulphur diminished in parallel levels, but the latter much more than the former, so that the proportion of oxydized sulphur to total sulphur was in general increased.

These modifications permit of two interpretations: (1) An increase in oxidation of sulphur; (2) an absolute loss of neutral sulphur. The first interpretation corresponds to the known oxydizing action of ultra-violet radiation—the second finds some support in observations of the writers on the action of neutral sulphur in melanodermas.

HENRY BAYON, M.D.

Intensity of Ultra-violet and Total Intensity of the Carbon Arc in Relation to Current and Length of Arc. G. Goldhaber. *Strahlentherapie*, May 20, 1931, XL, 723.

The author studied the characteristics of a carbon arc and came to the following conclusions: It is possible to augment the ultra-violet output of a carbon arc by increasing the current or the distance between the two electrodes. The total intensity increases also with

increasing current, but the increase of the arc length has no marked influence upon the total intensity. The ultra-violet intensity increases relatively more with increasing current than the total intensity. This is more pronounced in the case of alternating than in direct current arcs.

ERNST A. POHLE, M.D., Ph.D.

A Method for the Comparison of the Therapeutic Value of Various Sources of Ultra-violet Rays. A. van Wijk and E. H. Reerink. *Strahlentherapie*, May 20, 1931, XL, 739-742.

The authors used the absorption spectrum method for the comparison of the output of different light sources. Measurements with the cadmium cell showed the well-known fact that this cell is suitable for checking the output of one type of lamp under various operating conditions but not for direct comparison of different light sources.

ERNST A. POHLE, M.D., Ph.D.

NOT OTHERWISE CLASSIFIED

Dentistry as a Specialty of Medicine. Editorial. *Canadian Med. Assn. Jour.*, June, 1931, XXIV, 845-847.

From time to time prominent members of the dental profession have expressed the opinion that more complete knowledge of general medicine would add both interest and accuracy to the practice of dentistry.

On this side of the Atlantic, dental education has developed along rather different lines from those followed in Europe. In many of our schools the dental student receives instruction in anatomy, physiology, bacteriology, and pathology side by side with the medical student, but once these fundamental subjects are disposed of there is a parting of the ways. In Great Britain, the dental student must take lectures in medicine and surgery through two academic terms, and receive clinical instruction in these subjects at a recognized hospital over four academic terms.

Reference is made by the Editor to the controversy that is now raging in the dental

profession of the United States over the proposition of some of its leaders that dentistry should be made a specialty of medicine. On the one hand, there are advocates of the change, like Alfred Owre, Dean of Dentistry at Columbia University, who holds that "the mouth is too vital a part of the bodily economy to be relegated for either diagnosis or prescribed treatment to anyone less thoroughly prepared for either than a specialist in medicine." This view is supported by the Editor of *Clinical Medicine and Surgery*, who, in the June, 1929, issue suggests that "the next logical step for dentistry would seem to be to make it a regular specialty in medicine."

On the other hand, the Editors of *Dental Cosmos* and the *Journal of the American Dental Association* strongly oppose the proposed move. They claim the proposition is fostered by the universities to facilitate and simplify their educational problems. They point out that the dental profession has made much greater progress as a separate entity than if it had been tacked on to the medical profession.

This lack of unanimity on such an important matter among the members of the dental profession makes the possibility of community of organization with the medical profession a remote one. The encouraging evidence, however, of a better understanding between the professions makes possible the prediction for an ultimate union. In that union, the dental profession need not be more submerged as an organization than are those who practise a specialty in other medical fields. The initiative in the matter should be left, however, entirely to the dental profession. The attitude of the medical profession should be that of sympathetic interest and readiness to co-operate in any reasonable plan of fusion.

L. J. CARTER, M.D.

Contribution to the Treatment Method of Coutard. C. Fried. *Strahlentherapie*, 1931, XLI, 750-754.

The author admits that with the protracted fractional method of Coutard remarkable pal-

liation may be obtained in advanced tumor patients. However, the general use of this method should not be adopted before the question of late reactions has been studied further. It is quite possible that the application of 5,000 to 7,700 r may lead to serious injuries after a certain latent period. The economic factor must also be considered. In small hospitals or private laboratories, it is difficult to treat one patient for two or three hours daily unless several deep therapy machines are available.

ERNST A. POHLE, M.D., Ph.D.

A Seminal Vesiculogram. Frank Kidd. British Jour. Urol., June, 1931, III, 177, 178.

A case is reported of a patient who had been infected twice with gonorrhea. On both occasions he had suffered from an attack of epididymitis on alternating sides. His desire to ascertain whether or not he was fertile was satisfied by catheterization of the ejaculatory ducts. The right side was found patent and was injected with sodium iodide, and a roentgenogram, which demonstrated the vas, seminal vesicle, and ejaculatory ducts, was obtained.

DAVIS H. PARDOLL, M.D.

A Physiologic Effect of the Foehn Wind. Otto Kestner, Carl E. Johnson, and Walter Laubmann. Strahlentherapie, June 13, 1931, XLI, 171-173.

In persons who had been exposed to the Foehn wind, the blood pressure was found considerably lower than normal. It is possible that this explains the discomfort experienced under its influence.

ERNST A. POHLE, M.D., Ph.D.

Radiography and Medico-Legal Cases. J. G. Edwards. Med. Jour. Australia. Aug. 15, 1931, II, 194-197.

Large employers of labor for the purpose of lifting heavy weights would probably find it pays to have radiographic examinations

made before employing men, rejecting those applicants who show conditions frequently associated with "weak back," *e.g.*, irregular transverse processes of the fifth lumbar vertebra, sacralized vertebrae, etc. X-ray examinations of chests of applicants for work in mines has greatly lessened claims for compensation.

In spinal injuries, immediate X-ray examination is imperative for, at a later stage, it may be impossible to say if a bony abnormality was present at the time of the injury or if it developed as a result of the injury.

Injury to the vertebrae may interfere with the nutrition of the body, producing Kummell's disease.

Fractures of the odontoid process of the axis are frequently wrongly diagnosed, due to the overlap of the shadow of the ring of the atlas on the film. In making films of fractures, the rays should pass through the fracture at right-angles to the limb, or exaggeration of the displacement may occur. Stereoscopic or anteroposterior and lateral views are desirable.

In making X-ray examinations of the joints of the rugged type of working man, the roentgenograms should include the uninjured joint for comparison.

Radiologists are not to be blamed for "burns," developed when a patient, without informing the radiologist, has a second radiographic examination made within too short a period of the first examination. Twenty-one days is a safe period if there is no skin reaction.

The ownership of the film has never been settled in Australian courts, but in America it remains the property of the radiologist. It is unnecessary that roentgenograms be taken by the radiologist himself.

A radiologist should confine his legal evidence to the bony injury, in most instances leaving soft-tissue injury to the surgeon. He should be prepared to admit that soft-tissue injury may frequently cause as much, or more, disability than an actual fracture.

Various possibilities of mistakes in radiographs are considered in their medico-legal aspect.

J. G. STEPHENS, M.D.

On Hypericismus: A Contribution to the History of Light Pathology. W. Hausmann. *Strahlentherapie*, June 13, 1931, XLI, 145-154.

The author calls hypericismus a disease developing in unpigmented animals after they have eaten hypericum. Looking back in the history of medicine, it appears that this is the first sensibilization disease known to physicians. As the active substance, a dye called "hypericin," was isolated by Hans Fischer. It sensitizes particularly to the visible light region.

ERNST A. POHLE, M.D., Ph.D.

The Irradiation of the Interior of Body Cavities by Light Produced within These Cavities. S. Westmann. *Deutsche med. Wchnschr.*, 1931, LVII, 1495.

The author describes briefly his experiments with a spark gap enclosed in a small quartz tube which produces ultra-violet light as low as 2,500 Å. and may be produced in body cavities. For the irradiation of the stomach, for instance, it is placed in a stomach tube. For irradiation of the interior of the bladder, the apparatus was attached to a cystoscope.

So far forty-six cases have been treated. In chronic cystitis and in pelvic inflammatory diseases the results were encouraging. By varying the electrode material, the degree of evacuation in the quartz tube, or by adding certain gases, definite wave lengths may be produced.

Further studies along these lines are necessary in order to judge finally the efficacy of this method.

ERNST A. POHLE, M.D., Ph.D.

The Organization for the Campaign against Cancer in Baden. Kurt Weib. *Strahlentherapie*, June 13, 1931, XLI, 11-24.

Remarks to the Report of Dr. Weib. R. Werner. *Strahlentherapie*, June 13, 1931, XLI, 25, 26.

Weib describes in detail the fight against cancer in Baden. There are tumor clinics in

five large cities, two of these being connected with universities. Besides roentgen therapy, a total of 720 mg. of radium is available, which is allotted in equal shares to three of the clinics. Illustrations of posters used in the education of the public are shown.

In the following article, Werner, the head of the Heidelberg Tumor Clinic, outlines briefly the relations of the Baden organization to the central committee for the control of cancer.

ERNST A. POHLE, M.D., Ph.D.

CHEMICAL ABSTRACTS

X-ray Lines of Modified Frequency According to Ray. J. H. Van der Tuuk. *Naturwissenschaften*, 1931, XIX, 308.

The experiments of Ray and Majumdar were repeated (analysis of Cu K α -rays after passing through C, N or O) and a wholly negative result obtained in agreement with Cork (*Compt. rend.*, 1931, CXCI, 153). The experimental method used was as follows: A Metalix tube, Cu anode, Ni window as used, Siegbahn vacuum spectrograph (26 cm.), CaCo₃ crystal rotated continuously over 3°, slit width 0.1 mm. covered with goldbeater's skin; 15 K.V., 30 to 40 milliamperes. For absorbing electrode graphite, soot or C₆H₆ solution was used in sufficiently thick layer to give $\frac{1}{3}$ absorption of the incident ray. The exposure time was ordinarily 10 to 20 hours.

CHEMICAL ABSTRACTS.

X-ray Emission Spectrum and the Chemical Bond. Experiments with Secondary Rays. A. Faessler. *Naturwissenschaften*, 1931, XIX, 307, 308.

It was found previously that by treatment of various substances with X-rays many of the complications arising from cathode treatment can be avoided. A lamp sufficiently strong in secondary rays is a prime requisite. A few results are given. Measurement of the K α doublet of S in sulphates by the primary-ray method gives usually a triplet due to superposition of the S spectrum (5360.67 and 5363.50 X. U.) on the shifted sulphate spectrum (5358.13 and 5361.00 X. U.). In the

most stable sulphates only the $K\alpha$ doublet of sulphate is found, in easily decomposed compounds practically only the S doublet. By the secondary-ray fluorescence method only the sulphate spectrum appears. Complications due to chemical action of the anticathode metal on the substance have been repeatedly noted. By secondary ray the β -spectrum of S (5013.49 and 5018.84 X. U.) is found for MgS at 5017.22 and 5023.56 X. U. on Al as well as on Cu within the limits of error. The values on Cu by Lundquist were quite different.

CHEMICAL ABSTRACTS.

X-ray Spectroscopic Micro-analysis. G. von Hevesy. *Mikrochem., Emich Festschr.*, 1930, 163-165.

The advantages of X-ray spectroscopic methods for the detection and determination of quantities of material as small as 0.001 mg., or even less, are described. The lines of the L series should preferably be sought, on account of the relatively low tube voltage necessary for their production.

CHEMICAL ABSTRACTS.

Absorption Coefficients of Gamma Radiation from Radium D and Radium E, and the Number of Quanta Emitted by These. Susanne Bramson. *Ztschr. Physik*, 1930, LXVI, 721-740.

The absorption coefficient of the γ -rays of Ra D are: $\mu_{Al} = 1.17 \text{ cm.}^{-1}$; $\mu_{Cu} = 30.1 \text{ cm.}^{-1}$, corresponding to wave lengths of $2.6-2.7 \times 10^{-9} \text{ cm.}$, which is in good agreement with the value of $2.63 \times 10^{-9} \text{ cm.}$ obtained from the β -ray spectrum. Ra E has 2 components, $\mu_{Cu} = 7.4 \text{ cm.}^{-1}$ and $\mu_{Cu} = 0.85 \text{ cm.}^{-1}$, corresponding to $\lambda = 1.55 \times 10^{-9} \text{ cm.}$ and $\lambda = 5 \times 10^{-10} \text{ cm.}$ The first component is the $K\alpha$ radiation of Po (the immediate decomposition product of Ra E), excited by the primary β -rays of Ra E; the second is from the nucleus of Ra E, and is, perhaps, due to the stoppage of the β -rays. The error of the measurements is about 4 per cent in the case of μ_{Al} for Ra D and for the $K\alpha$ radiation of Po, while for

the other values the error may be as high as 10 per cent. For Ra D, 3.1 ± 1.2 quanta are emitted per 100 atoms disintegrating. From Kikuchi's value for absorption within the atom (95 per cent), this is equivalent to an emission of one quantum per disintegrating atom. J. A. Gray's value for absorption within the atom leads to erroneous results. For Ra E, 0.5 ± 0.25 quantum per 100 atoms was measured and 1.1 ± 0.5 quantum for the Po $K\alpha$.

CHEMICAL ABSTRACTS.

The Ultra-violet Absorption by Hydrochloric Acid Solutions. R. Tréhin. *Compt. rend.*, 1930, CXCI, 774-776.

By using 10-mm. and 20-mm. thicknesses of aqueous HCl solutions varying in concentration from 0.5 to 1.3 molecules per l, over the range 2,816 to 1,990 Å.U., the absorption was found to increase continually with decrease in wave length for a given solution of given thickness. For each wave length greater than 2,320 Å.U., the absorption increased constantly with concentration. Below 2,320, the absorption increased at first with the concentration and reached a maximum for a given concentration. This maximum decreases with further advance into the ultra-violet. Because of this maximum, Beer's law does not hold for concentrated aqueous solutions of HCl. The absorption of dilute solutions is generally considered to be due to Cl ions, but the nature of the particles causing absorption must change with an increase in concentration.

CHEMICAL ABSTRACTS.

Experimental Oil-immersed X-ray Apparatus. R. D. Bennett, N. S. Gingrich, and W. C. Pierce. *Rev. Sci. Instruments*, 1931, II, 226-230.

An oil-immersed X-ray apparatus is described and the advantages are discussed. This apparatus differs from previous arrangements in that auxiliary kenetron rectification is used instead of self-rectification, permitting greater power.

CHEMICAL ABSTRACTS.

Determination of Crystallite by Means of X-rays. L. Grebe. *Ztschr. tech. Physik*, 1930, XI, 428, 429.

Debye lines are obtained with the specimen and with a pure comparison substance, and the intensities are compared. The intensity is proportional to the crystallite content, and not to the particle size. The method is applied to quartz in clay, etc.

CHEMICAL ABSTRACTS.

Structure of Solid N_2O_4 at the Temperature of Liquid Air. L. Vegard. *Ztschr. Physik*, 1931, LXVIII, 184-203.

A new camera for determination of the crystal structure of solidified gases at low temperature and an X-ray tube suitable for this purpose are described. N_2O_4 belongs to the cubic system, space group T^s and has a lattice constant of 7.7 Ångström units. The elementary cell contains 12 NO_2 molecules which are symmetrical, linear, and always arranged in chains of 4 molecules with 3 chains perpendicular to each other.

CHEMICAL ABSTRACTS.

The Stability of Irradiated Ergosterol. A. Windaus and E. Auhagen. *Ztschr. physiol. Chem.*, 1931, CXCVI, 108-120.

In order to determine the stability of irradiated ergosterol at various temperatures in the complete absence of O, an elaborate quartz apparatus was constructed in which the sample could be irradiated, the unchanged ergosterol frozen out and filtered off, the filtrate dissolved in a suitable solvent and distributed into various compartments subsequently sealed off, then subjected to various temperatures and examined polarimetrically and spectroscopically, all this in a closed system from which atmospheric O had been excluded. No fundamental difference was observed between preparations irradiated with Mg and with Hg light. At ordinary temperature they slowly undergo alteration. At temperatures up to 100° this alteration is of the same character and reaches the same end point but occurs much more rapidly. An initial $[\alpha]_D^{18}$ of -17°

risks to 0° in 8 days and to $+7^\circ$ in 50 days at a temperature of 20° , where it remains constant. At a temperature of 100° the rotation rises to 4.5° in 4 hours. The increase in rotation is accompanied by an increase in absorption, especially at the maximum of 280 $m\mu$. The substance which undergoes this alteration is not the vitamin, since the decrease in antirachitic potency is only slight and does not follow the curve of increasing rotation and absorption. At higher temperatures, however, new reactions occur which destroy the vitamin without affecting the toxic factor. After 4 hours' heating at 150° , the rotation increases to 83° and the maximum absorption is shifted to 290 $m\mu$. It appears that the vitamin with its main absorption at 260-80 disappears and is superseded by a new and inert substance with a main absorption at 285-305 $m\mu$.

CHEMICAL ABSTRACTS.

Animal Experiments with Calcium and Irradiated Ergosterol, with Particular Reference to Thyroxine Sensitivity. G. Roesler. *Arch. exptl. Path. Pharmacol.*, 1930, CLXV, 114-128.

Large quantities of Ca administered to normal rats caused motor disturbances, loss of hair, cutaneous hemorrhages, and death. Irradiated ergosterol alone had no effect, but the animal's susceptibility to the metabolic effects of thyroxine is very much decreased, an effect not obtained with either substance alone. Milk of cows on a green fodder diet had the same effect as ergosterol, but winter milk did not. Ergosterol therefore affects the distribution of Ca in the body.

CHEMICAL ABSTRACTS.

The Application of Electron Interference to Structure Analysis. E. Rupp. *Physik. Ztschr.*, 1930, XXXI, 1076-1078.

Using slow electrons (100 volts) which penetrate only about ten layers of atoms in a crystal, Rupp studied surface layers of metals. The penetration was carried out in a high vacuum and by heating all metallic parts; these precautions did not eliminate all changes in the

surface layers. Intensity measurements were not dependable, but the deflection maxima were always reproducible. A crystal of Cu heated to 400° for 30 minutes showed faint maximum; heating the same crystal to 850° for 2 hours gave definite deflexion maxima; heating the crystal to 850° and spraying the surface with electrons from 10 K.V. and 1-3 ma. diminished the maximum. In these three determinations, the maximum position agreed to within 3 kilovolts. The adsorption of H upon a surface layer gives rise to new deflection maxima, which are only 0.5 as high as the original and disappear on heating the metal intensively. No explanation is given for their appearance. The passive state in Fe produced five new maxima; this was also observed when W was coated with a film of oxide.

CHEMICAL ABSTRACTS.

Influence of Ultra-violet Light on Certain Organic Aromatic Substances. Siegfried Michael. *Biochem. Ztschr.*, 1931, CCXXXIII, 470-477.

By using E. von Hornbostel's concept of smell sensation whereby this is described by a scale similar to that used for light sensation intensities, it is found that each class of substance undergoes a change as a result of ultra-violet radiation which is typical for it and is caused by definite chemical alterations. The chemical change and hence the change in smell depend upon the manner and duration of the radiation. Methods are also described for the determination of the chemical alteration and of the degree of smell. Radiation with the long wave portion of the ultra-violet spectrum is less than with the whole spectrum.

CHEMICAL ABSTRACTS.

Chemical Causes of the Radium Radiation Coloration of Silicate and Quartz Glasses. Josef Hoffmann. *Ztschr. anorg. allgem. Chem.*, 1931, CXCVII, 29-51.

The basic cause for the coloration of glasses by ultra-violet and Ra rays is the charging and discharge process of free electrons. Gray discoloration is the most difficult to explain

and possible theoretical causes are suggested based on Mn and Fe ions of different valence. Mn^{III} ions limit the blue color change of silicate glasses. This coloration clears up after some time and a more stable amethyst color persists. Parallel striated colorations in radiated glasses are due to phase separation. Mn^{III} ions are obtained with both Ra and ultra-violet radiation. Mn^{II} causes the brown coloration of glass flasks. The violet coloration of quartz glass is due to Fe⁺⁺ and Fe⁺⁺⁺ ions in the presence of Ti. Extensive tables are given for the coloration of Mn and Mn-free glasses, colored glasses, etc.

CHEMICAL ABSTRACTS.

Emanation Yield from Radio-active Luminous Paints. P. M. Wolf and N. Riehl. *Ztschr. tech. Physik.*, 1931, XII, 203-205.

Quantitative measurements were made on a number of radio-active luminous paints. Data are given. Ra paints emit as much as 30 per cent of the incipient radiation into the air. The amount increases with static charge and with increase in humidity. Meso-Th paints are less emissive than the Ra paints. The authors state that injury might come to workers with Ra paints.

CHEMICAL ABSTRACTS.

Scattering of X-rays by Mercury Vapor. Y. H. Woo. *Nature*, 1931, CXXVII, 556, 557.

The comparison of experimental data by Scherrer and Stäger with a theoretical formula previously described (*Proc. Nat. Acad. Sci.*, 1930, XVI, 814) shows satisfactory agreement.

CHEMICAL ABSTRACTS.

Precision Measurements of the Lattice Constant of Cuprous Oxide. M. C. Neuburger. *Ztschr. Physik*, 1931, LXVII, 845-850.

The lattice constant of purest Cu₂O is 4.252 ± 0.002 A.U., the volume of the elementary cell $V = 76.87$ (A.U.)³; the density

6.14. The powder method and Fe *K* radiation were used. Very pure Cu_2O was prepared by addition of hydrazine sulphate solution to Fehling solution, washing and drying at 110° . The content of Cu was estimated electrolytically and the preparation found to be of 99.81 per cent purity.

CHEMICAL ABSTRACTS.

The Action of Roentgen Rays on the Material of Inner Secretion and Organ Poisons. Bunjiro Terata and Ryôichi Ito. *Folia Pharmacol. Japon.*, Breviaria 4-5, 1931, XII, No. 1, 67-73.

The action of adrenalin on blood pressure is increased by moderate roentgen rays, but is inhibited by strong rays. The effect of pituitrin and thyroid powder extracts on blood pressure is reinforced by the rays. Many organ poisons which affect blood pressure are hindered by the rays. The action of histamine and peptone is decreased.

CHEMICAL ABSTRACTS.

Crystal Structure and Polymorphism of Hydrogen Halides. G. Natta. *Nature*, 1931, CXXVII, 235.

The cubic modification of HCl has a 5.44 \pm 0.01 Å.U. at the transition temp. [98° ?]; the volume of the elementary cell is 161×10^{-24} c.c.; density (calculated) for a cell containing 4 molecules is 1.49. At 85° absolute the second form of HCl shows numerous lines of which only a certain number correspond with the tetragonal system for c/a 1.10 with a 5.27 Ångström units. HBr is also dimorphous, the high-temperature modification showing at 100° absolute a face-centered cubic structure, a 5.77 Å.U. density (calculated) for a cell of 4 molecules 2.78, and the volume of the elementary cell 192×10^{-24} c.c. The low-temperature modification shows tetragonal symmetry (or possibly pseudotetragonal) with a 5.55 Å.U., c/a 1.10, and the volume of the cell 188×10^{-24} c.c. at 90° absolute. Conclusions concerning the structure of HI are revised. The structure is face-centered tetragonal and not face-centered cubic, with c/a 1.08, and a 6.10 Å.U. at 100° absolute density (calcu-

lated) 3.45, and the volume of the cell is 245×10^{-24} c.c. The calculated ionic radii are Cl^- 1.92, Br^- 2.04 and I^- 2.21.

CHEMICAL ABSTRACTS.

The Number and the Inner Absorption of γ -rays of Radium D. E. Stahel. *Ztschr. Physik*, 1931, LXVIII, 1-11.

Previous measurements showed that 100 decaying Ra D atoms yield only three γ -quanta. Moreover it could be concluded from the monochromatic lines of the γ -ray spectrum that these lines must be due to secondary β -electrons, and it is assumed that for each electron one γ -quantum must be absorbed. The number of secondary β -particles is therefore determined, Riehl's device with a Geiger counter being used. A special study was made to insure the reliability of the method and Riehl's results could be completely confirmed in contradistinction to those of C. T. Chase. The number of particles was counted with and without a magnetic field and with or without a screen interposed between the source of radiation and the counter. From these four figures, the number of the primary and secondary elections, the α -particles and the residual effect could be found.

Results.—(1) It is possible to count β -particles quantitatively with the help of a Geiger counter containing air of suitable pressure (depending on the velocity of the electrons); (2) 100 decaying Ra D atoms produce 83 secondary β -particles. Each of them corresponds to one quantum of absorbed γ -radiation. Ninety-six per cent of the total γ -radiation is therefore absorbed by the inner electrons.

CHEMICAL ABSTRACTS.

Quantitative Analysis of Iron Alloys by Means of X-ray. Shigetaka Shimur and Masao Takasu. *Tetsu-to-Hagané (Jour. Iron and Steel Inst.)*, 1930, XVI, 961-970.

The paper deals with the quantitative analysis of Fe-Ni-Mn alloys by means of radiation spectra. The four alloys used in this

study were prepared in an electric furnace from electrolytic Fe, metallic Mn, and metallic Ni. These alloys contained 3.6–13 per cent Mn and 3–10 per cent Ni. The characteristic X-ray was produced by a Hadding tube, analyzed with a spectrograph, and then exposed to a dry plate. The intensity of the *K*-series lines was measured by a Noll's microphotometer, and from the values thus obtained the contents of Mn and Ni were calculated. The results obtained often differed widely from the actual contents; that is, 0–25 per cent errors for Mn and 0.5–15 per cent for Ni. This error will be reduced by replacing plates used and by more skillful manipulation of the photometer.

CHEMICAL ABSTRACTS.

Selection Rules for the Absorption Spectra of Roentgen Radiation. Manne Siegbahn. *Ztschr. Physik*, 1931, LXVII, 567–571.

It easily seems, from the energy diagrams, that the M_γ absorption edge can be calculated from $M_\gamma = L_{III} - L_{III} M_\gamma$ ($L_{III} M_\gamma$ is the frequency emitted in the transitions from level M_γ to level L_{III}), but the experimentally measured value differs considerably from the calculated. It is, therefore, suggested that the electron in the absorption act is not brought to the "surface" of the atom, but received in one of the unoccupied *O*-levels. Selection rules identical with those for the emission line are supposed to hold for these transitions. The various cases for the elements from W to U are explained in a Grotrian diagram and in tables.

CHEMICAL ABSTRACTS.

Roentgenographic Investigation of the Coagulation Process of Colloidal Gold. P. Scherrer and H. Staub. *Helv. Phys. Acta*, 1930, III, 457.

The half breadth, B , of a Debye-Scherrer line is connected with the length, Λ , of the crystal edge constituting the crystal powder in the following way: $B = 2\sqrt{\lg 2/\pi}(\lambda/\Lambda)[1/\cos(\Theta/2)] + b$, in which λ is the wave length of the X-rays, Θ the angle between incident

and reflected beam, and b a constant. Au colloids prepared by reduction of aqueous AuCl_3 with P in ether consist of crystals of 13×10^{-8} cm. linear extension. Addition of gelatin before reduction diminished their size to 8.7×10^{-8} centimeters. Rapidly coagulated colloids possess nearly the same magnitude, but if they are left in contact with electrolytes, they grow together to larger crystals. Dried colloids do not differ essentially from the primary particles in fineness. Addition of a protecting colloid, *e.g.*, gelatin, hinders the growth of the primary particles in an electrolyte.

CHEMICAL ABSTRACTS.

Ultra-soft X-rays. V. Dolejšek. *Compt. rend.*, 1931, CXCII, 1088, 1089.

Using a modification of Osgood's method, the author obtained a series of lines for Mg (used as the cathode and covering the target) the most intense of which is a doublet at approximately 480 Ångström units. Further work is being carried out with other elements.

CHEMICAL ABSTRACTS.

Quantitative Analysis by X-rays. T. H. Laby. *Nature*, 1930, CXXV, 818.

In a reply to von Hevesy it is reaffirmed that the *K* X-ray spectrum of an element present to less than 0.0001 per cent in a metal can be photographed.

CHEMICAL ABSTRACTS.

The Determination of Size and Form of Submicroscopic Crystals with X-rays. R. Brill. *Kolloid Ztschr.*, 1931, LV, 164–169.

The half value width (H.V.W.), or the width of the X-ray interference between two points at which the intensity amounts to one-half the maximum intensity, is a measure of the resolving power of a crystal lattice. An increase in H.V.W. is noticeable at particle sizes of 10^{-5} centimeters. The lower limit for measurements is at the transition from the crystalline to the amorphous state. In practice, the action of a large number of particles is ob-

served on the Debye-Scherrer photograph. H.V.W. is determined by photometric measurements along the equator of the photograph. The method assumes that the blackening is proportional to the intensity of the radiation and that the reading of the photometer is proportional to the blackening. For $K\alpha$ X-rays, the following equations apply: For $\delta \leq \frac{2}{3}b$, $B = \frac{b}{2} [1 + \sqrt{1 - (\frac{4}{3}) (\frac{\delta}{b})}]$ and for $\delta > \frac{2}{3}b$, $B = (\frac{2}{5}) (b + \delta)$, where B is the true value of H.V.W., b is the measured value, and δ is the distance between the maximum of the α_1 and α_2 radiation. The method can be applied only where X-ray absorption is negligible. This is accomplished (1) by the use of thin-walled hollow cylinders and (2) by the use of thin plates (collodion strips cut to definite size). The apparatus must be carefully defined in that the incident opening for the X-rays must be a point and that the distance of the opening to preparation point is the same as the preparation-to-interference distance. From the measurements a function η is calculated by means of an equation depending on the form of the preparation and the Debye-Scherrer chamber. The function η depends on the size and form of the crystal. The exact faces of the crystal are determined by checking the H.V.W. repetition from various assumed faces.

CHEMICAL ABSTRACTS.

PHYSICAL ABSTRACTS

The First Spark Spectrum of Rubidium (Rb II). Otto Laporte, George R. Miller, and Ralph A. Sawyer. *Phys. Rev.*, Sept. 1, 1931, XXXVIII, 843-853. (Reprinted by permission.)

The resonance lines of Rb II have been photographed in the extreme ultra-violet region with the vacuum spectrograph. The mode of excitation was the hollow cathode discharge in helium, and, in addition, the hot spark was employed with rubidium hydroxide in cored aluminum electrodes. The values of the wave lengths of the ultra-violet lines for Rb II were obtained from third order measurements. The visible region was photo-

graphed with various glass and quartz spectrographs. With the separations of the resonance lines as guides, the classification scheme given by Reinheimer was found to be correct, but incomplete. Some lines taken from Otsuka's data were fitted into the scheme. The coupling is of an intermediate type approaching that of (jj) form. Levels of the $4p^54d$, $4p^55s$, $4p^55p$, $4p^55d$, and $4p^56s$ configurations were identified. Their separations were compared with Kr I. It was also attempted to separate the 3P_2 and 3P_1 terms due to $4p^5(5s, 6s)$ from the $4p^5(4d, 5d)$ levels. The limit of excitation furnished by metastable helium falls exactly between the various levels caused by the $4p^55p$ configuration, thus providing a check on the interpretation of the classification. The ionizing potential of Rb II was calculated to be 27.3 volts.

The Photo-electric Behavior of Salts, with Special Reference to the Effect of Light of Long Waves on Salts Irradiated with Light of Short Wave Length. K. Klaphecke. *Ztschr. Physik*, 1931, LXVII, 478-496.

The yield of photo-electrons from CdI_2 or $PbCl_2$, precipitated from the solution of a soluble salt, is found to be considerably larger than when the material has previously been dried by sublimation in high vacuum. These salts show no sensitivity to light of long wave length but become sensitive to it after irradiation with ultra-violet light. The photo-electric effect due to the light of a Hg arc alone or in combination with light of long waves is nearly proportional to the light intensity.

CHEMICAL ABSTRACTS.

Spectral Fluorescence Efficiencies of Certain Substances, with Applications to Heterochromatic Photographic Photometry. George R. Harrison and Philip A. Leighton. *Phys. Rev.*, Sept. 1, 1931, XXXVIII, 899-908. (Reprinted by permission.)

In extending the method of fluorescence photographic photometry recently described by the writers from homochromatic to hetero-

chromatic usefulness, experiments have been carried out on the efficiencies of fluorescence of various substances in the visible and ultra-violet regions. A number of substances fluorescing at wave lengths between the red and the ultra-violet have been tested, and many of these have been found to exhibit the same variation of fluorescence efficiency with wave length, when in a pure state and in solutions of proper concentration. The intensity of the fluorescence light emitted by them when illuminated with light of constant intensity at different wave lengths was measured and found to be such that the number of quanta emitted was practically proportional to the number of incident quanta over a wide range of wave lengths. This is in contradiction to certain results previously announced by other workers who found the emitted energy proportional to the incident energy, but is confirmed by other results and by well-known photochemical laws. Small traces of impurities in certain of the fluorescing substances, particularly *æsculin*, produce large variations in the efficiency of response, which appears to explain the conflicting results previously obtained. The general relation found is applied to the development of a simplified method of heterochromatic photographic photometry useful in the range 3,900–2,000 Å., which it is believed can be extended to the Schumann region. The end desired is attained by photographing the fluorescence light emitted when the spectrum is allowed to fall on a plane surface of the substance, or by use of a dry plate with fluorescent coating, which shows not only constant contrast but almost uniform quantum sensitivity over a large spectral region. Small corrections need to be applied for variation in reflecting power of the coated emulsion, but these are all of the type which can be measured and controlled by homochromatic photometry.

The Shortest Wave Length in the Sun.
F. W. Paul Götz. *Strahlentherapie*, May 20, 1931, XL, 690-695.

The author concludes his investigations as follows: "The shortest wave length of clear

sunlight is in direct relation to the amount of ozone in the atmosphere. The shortest wave length in the sun in Arosa, based on a spectrogram with three hours' exposure, amounts to 2,863 Ångström units."

ERNST A. POHLE, M.D., Ph.D.

Measurement of Light in Climatology and Medical Practice. Konrad Büttner. *Strahlentherapie*, 1931, XLI, 205-231.

This is a description of the most commonly used instruments for the measurement of light. Photo-electric cells are discussed in detail, and the electrometer method, with the various sources of error, based on the experience of the meteorologic observatory in Potsdam, is also outlined. A bibliography indicates selected articles on the subject.

ERNST A. POHLE, M.D., Ph.D.

A Method for the Production of Intensive Monochromatic Roentgen Rays by Means of Standard X-ray Tubes, and Several Applications of the Method. Hans Küstner. *Strahlentherapie*, 1931, XLI, 305-308.

This is a brief description of a physical laboratory method permitting the production of monochromatic X-rays of considerable intensity, which will be published in detail in the *German Physical Journal*.

ERNST A. POHLE, M.D., Ph.D.

The Satellites of M-series X-ray Lines. F. R. Hirsh, Jr. *Phys. Rev.*, Sept. 1, 1931, XXXVIII, 914-924. (Reprinted by permission.)

Four satellites of the diagram line $M\alpha_1$ have been measured in the range of atomic numbers from U (92) to Yb (70). Two of these satellites have not been reported previously. Three satellites of the diagram line $M\beta$ have been measured in the range of atomic numbers from U (92) to Gd (64). Two of these satellites have not been reported previously. Superposition of the semi-Moseley graphs for the satellites of $M\alpha_1$ and $M\beta$ gives rise to the suggestion that perhaps both X-ray

lines are modified by the same optical lines. All these observed satellites obey the "Moseley law"—the data giving a straight line within experimental error. The semi-Moseley graph of the satellite $M\beta^{II}$ shows a significant break at atomic number 70. The satellites of $M\alpha_1$ vanish at Er (68), coincident with the splitting of the $M\alpha_1$ line into three components at this place, *i.e.*, at atomic number 68. The range of values of $\Delta\nu/R$, between satellite and parent line, is from 0.1 to 2.0, in agreement with the results of previous workers, for the satellites of K and of L series lines. A peculiar continuous spectrum accompanies the satellites of $M\alpha_1$ and $M\beta$ for the elements U (92) and Th (90).

The Theory of Electric Contact. W. Ehrenberg and H. Hönl. *Ztschr. Physik*, 1931, LXVIII, 289-308.

The process of breaking an electric contact from the wave-mechanical standpoint is studied. When the metallic surfaces are as much as 10 Å.U. apart, the current still flows. The reason for this behavior of the electrons is that they are able to pass the "potential barrier" between the two metallic surfaces, even when their energy is smaller than the maximum height of the potential barrier. This effect would not be possible according to classical mechanics.

CHEMICAL ABSTRACTS.

The Phenomenon of Recoil and the Conservation of Momentum. F. Joliot. *Compt. rend.*, 1931, CXCII, 1105-1107.

In about 25 per cent of the cases of α -ray emission, the recoil atom does not move along the prolongation of the α -ray path as it should do according to the laws of mechanics. Some of the trajectories observed showed a slight thickening at the origin, indicating the possible existence of another short trajectory. Working at pressures (in the Wilson cloud chamber) in the neighborhood of the vapor pressure of water, giving the recoil atom a path of about 7 mm., the author obtained the following results: (1) The recoil radiation

may be sharply inclined to the direction of the α -ray; in this case, at least a third trajectory issues from the point of disintegration; (2) along the length of the recoil path several trajectories branch off, some of which are longer than that of the undeviated recoil atom; (3) in rare instances, the recoil atom during its path receives a shock causing notable deviation. Its path then becomes that of the atom responsible. In (1), the angles between the paths indicate that the deviations are caused by heavy atoms, probably An or Act A. In (2), the trajectories along the recoil path are due to light gas atoms, and occasionally to electrons. The explanation of (3) is still doubtful. The hypothesis of a high-energy γ -radiation associated with the disintegration of An or Act A seems unnecessary.

CHEMICAL ABSTRACTS.

X-ray Intensimeter. K. Adati and K. Miyaki. *Electro-tech. Lab., Tokyo, Japan, Circ.*, 1930, No. 70, 13; *Science Abs.*, XXXIV A, 40.

This paper describes some results on the measurement of X-ray intensities by the galvanometer method.

CHEMICAL ABSTRACTS.

The Complexity of the α -radiation from Radio-actinium. Irene Curie. *Compt. rend.*, 1931, CXCII, 1102-1104.

A method is described for the preparation of RdAct free from its derivatives, and of measuring the range of the radiations. Measurements show that the α -radiation of RdAct is composed of two clearly separated groups having about the same range as those already known for RdAct and Act X. A study of the evolution of activity showed that no Act X was present in the original preparation. It was also shown that the feeble radiation was not due to the slowing-up of some of the rays by the source. The two groups have ranges of 4.68 and 4.34 cm. in air at 15° and 760 millimeters. This may indicate either a branching or a fine structure of the α -rays. The difference of energy between the two groups is 2.8×10^5 volt-electrons, approx-

imately the energy of the quantum of the most penetrating α -radiation of Act X (2.68×10^5 volts), or of those of RdAct (2.82×10^5 volts and 3.00×10^5 volts).

CHEMICAL ABSTRACTS.

A New Effect Produced by Action of X-rays on Matter. G. I. Pokrowski. *Phys. Rev.*, Sept. 1, 1931, XXXVIII, 925-930. (Reprinted by permission.)

This paper describes an investigation of the weak radio-activity which some heavier elements acquire after being irradiated by X-rays. The first method of investigation of this effect is based on the measurement of the ionization produced by the sample after irradiation. The second method consists in the counting of the scintillations produced by particles emitted by the irradiated substance. The combination of these two methods makes it possible to determine the mean energy of each emitted particle. This energy is of the order of 10^{-6} erg. It seems quite impossible that particles of such energy could be emitted from the extra-nuclear electrons. It is much more probable that they originate in the atomic nuclei. On the other hand, it is not possible to explain such results by radio-active contamination. Some possible explanations of the phenomena observed are discussed.

An X-ray Study of the Magnetic Character of Liquid Crystalline Para-azoxyanisol and a Comparison with the Isotropic Liquid. G. W. Stewart. *Phys. Rev.*, Sept. 1, 1931, XXXVIII, 931-942. (Reprinted by permission.)

The effect of a magnetic field upon the orientation of the liquid crystalline groups in para-azoxyanisol has been studied by means of the angular distribution of X-ray relative diffraction intensities, the magnetic field being oriented perpendicular to the incident X-ray beam and the axis of the spectrometer. The relative number of the large molecular groups in the liquid crystalline condition, oriented

perpendicular to the field, was obtained by the application of the Boltzmann distribution law in two theories; one assuming a permanent magnetic moment and the other anisotropic polarization. The latter theory of orientation agrees with the claim of Foex as to the cause of the decrease of the magnitude of the diamagnetic susceptibility in the milky state. Moreover, the experiments, together with general considerations, are in harmony with the second theory. Thus the experiments agree with the contention of Zocher, Jezewski, and Foex, and are opposed to the conclusions of Kast, who favored the first theory.

The magnetic effect was decreased in a marked manner by the slow mechanical rotation of the cylindrical vessel containing the liquid crystal and also by the increase of the number of cycles of an alternating magnetic field. In the liquid crystalline state (117.4° to 134°C.), the X-ray diffraction intensity at the principal maximum is 10 per cent greater than in the transparent liquid (at 143°C.). This is explained by the existence of cybotactic liquid groups in the latter case and the grouping of a large number of these "companies" into the large "regiment" which is responsible for the liquid crystalline phenomena. "A theoretical justification is found in Ornstein and Oseen's theory of the liquid crystalline condition." The marked optical and the small X-ray difference in the two conditions are thus easily explained. The difference between the liquid crystalline and the transparent liquid condition is thus found to be mechanically not so great as optical observations would indicate. In detail, using distances small compared to an optical wave length, the liquid is never isotropic but consists of the cybotactic groups oriented in all positions. The effect of the magnetic field upon the transparent liquid is too small to measure. This is explained by the smallness of the cybotactic groups. The view of the author as to the existence of temporary approximate groups (cybotactic) in the transparent liquid is clearly strengthened by the straightforward interpretation of these experiments.

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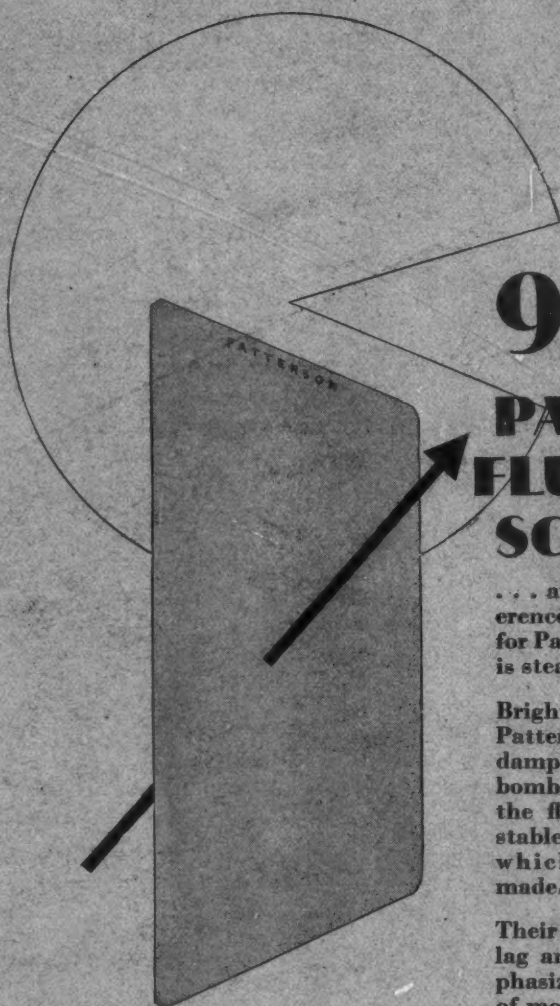
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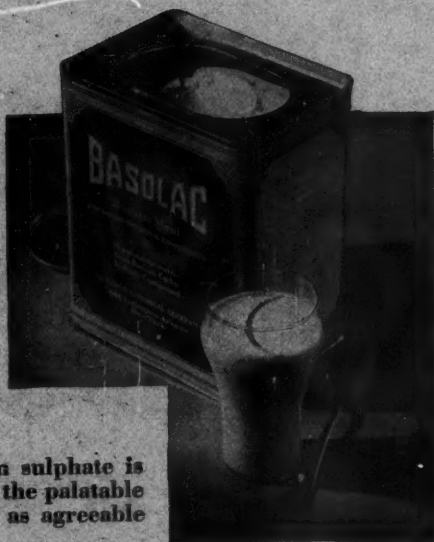
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